

**AN INTACT CHEST FROM THE 1686 FRENCH SHIPWRECK *LA BELLE*,  
MATAGORDA BAY, TEXAS: ARTIFACTS FROM THE LA SALLE  
COLONIZATION EXPEDITION TO THE SPANISH SEA**

A Thesis

by

MICHAEL CARL WEST

Submitted to the Office of Graduate Studies of  
Texas A&M University  
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

May 2005

Major Subject: Anthropology

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Approved as to style and content by:

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Donny L. Hamilton  
(Chair of Committee)

---

James Rosenheim  
(Member)

---

C. Wayne Smith  
(Member)

---

David Carlson  
(Head of Department)

May 2005

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## ABSTRACT

An Intact Chest from the 1686 French Shipwreck *la Belle*, Matagorda Bay, Texas: Artifacts from the La Salle Colonization Expedition to the Spanish Sea. (May 2005)

Michael Carl West, A.B., Cornell University

Chair of Advisory Committee: Dr. Donny L. Hamilton

In 1995 Texas Historical Commission (THC) staff and a team of researchers discovered a shipwreck in the mud of Matagorda Bay. Preliminary artifact recovery included a decorated bronze cannon that identified the wreck as *la Belle*, the fourth and final vessel of the ill-fated venture to found a colony on the Texas coast by French explorer Robert Cavalier Sieur de La Salle. A full excavation of the site was conducted in the following years. Among the items recovered was an intact chest (Artifact No. 11500) which at the time became known as the *Belle* Mystery Chest. Initial inspection revealed that the chest was most likely a repository for various tools, but further work revealed a sundry collection of artifacts. Subsequent artifact analysis determined the tools to be instruments used in a variety of occupations ranging from that of French wine coopering to those of agricultural, military, and maritime endeavors. Historical research primarily using the firsthand reports from the expedition's survivors suggest the chest was first boarded in France on one of La Salle's other ship's, *l'Aimable*, unloaded prior to that vessel's wrecking at the mouth of Matagorda Bay, taken to the new settlement by way of *la Belle*, and eventually returned to the ship just prior to its sinking. Records verify that La Salle often claimed the possessions of the dead and that he ordered the ship reloaded with his personal goods and other supplies before it sank. Along with two artifacts with differing ownership initials and the sheer diversity of the chest's contents, these clues suggest that the chest may have been a repository for various utilitarian items collected by La Salle before the loss of *la Belle* in January of 1686.

For Grandma West and Grandma Z, both of whom passed away during my time on this project.

For as long as I can remember, you always inspired me to read more, do more, be more.

Your belief in me has always been a driving force in the work that I do.



## ACKNOWLEDGEMENTS

This work is as much a product of my own as it is those persons who donated their time, money, and interest to my project, the examination of the Mystery Chest from *la Belle*. Donny Hamilton hired me at the Conservation Research Laboratory at Texas A&M even before my first semester officially began. Continued support through my four years there, including the summers, enabled me to live off of slightly more than the normal graduate student fare of ramen noodles.

The staff of the CRL was instrumental to my education, numerous artifact discussions, and general aid throughout the entire process. Helen Dewolf got her daily exercise running between her building and where I was working every time I went to tell her about some new discovery. Her guidance and suggestions on how to separate the entangled contents of the chest, her interpretation of difficult x-rays, and brainstorming sessions on the artifacts and their implications probably allowed me to finish my thesis at least a year earlier than would have otherwise occurred. I also learned what little artifact drawing skills I possess from her, though I bear the credit for the simplicity of my products. Jim Jobling's enthusiasm for what he called "the real treasure of *la Belle*" helped to identify a number of the woodworking tools I had never seen before. He was also essential to getting me the supplies and proper set-up I needed in order to conduct my examination and conserve the recovered artifacts. John Hamilton often received much of my youthful, wide-eyed enthusiasm of "Isn't this cool?! Come see what I just found!" His patience was unbounded in helping me any time I asked, often at the expense of a banged thumb or other minor injury. Many graduate students working at the CRL also helped in major and minor ways, and my thanks to them for everything as well. Amy Borgens, Peter Fix, Starr Cox, John Swanson, and Carrie Sowden deserve special mention.

Jim Bruseth, Lillie Thompson, and the staff of the Texas Historical Commission guided me with various research leads and allowed me to obtain images of the chest as it was first exposed during the archaeological recovery phase. Donny Hamilton, C. Wayne Smith, and James Rosenheim all served on my committee, taking an active interest and urging me to graduate as soon as possible! Conversations with many other professors, professionals, and experts expanded my understanding of the work and often lead me to pursue new avenues of research. These include Filipe Castro, Kevin Crisman, Kathleen Gilmore, Sylvia Grider, Thomas Oertling, Cemal Pulak, and Greg Waselkov. Vaughn Bryant deserves special mention for his time in helping me identify the species origin of the chest's clump of hair. Gregor Kalas put me in contact with Ian Muise in the Architecture Department for the use of a large flatbed scanner for oversized drawings. Additionally, sections of this thesis were researched and written for courses taught by Donny Hamilton (Jamaican woodworkers archives), Kevin Crisman (maritime woodworking professions), and Rob Bonnicksen (taphonomy of the chest), who unexpectedly passed away 24 December 2004.

Thank you also to the many project donors who made the recovery of *la Belle* and its contents possible. Their donations of time, money, and expertise were invaluable. These benefactors include ISTE Texas Department of Transportation, Dennis O'Connor, The Cullen Foundation, The Fondren Foundation, The Houston Endowment, Inc., The Meadows Foundation, Mobil Exploration & Producing U.S., Inc., Shell Oil Company Foundation, The Summerlee Foundation, The Trull Foundation, and Matagorda Country Navigation District One. As of March 2005, a full list of the La Salle Shipwreck Project Donors can be found at <http://www.thc.state.tx.us/lasalle/lasbelledonor.html>. Additionally, the support given to the Conservation Research Laboratory in the form of supplies from various companies enables us to perform our work at reasonable rates while we work to preserve our nation's history. A few of these donors whose supplies directly helped with my project include: Food Services, TAMU; Fuji NDT Systems; GE Silicones; Northrop Grumman; Coroplast, Inc.; Devcon Plexus; The Dow Chemical Company; and Progressive Epoxy Polymers. As of March 2005, a full list of the CRL's donors can be found at <http://nautarch.tamu.edu/lasalle/sponsors.htm>.

Amy Borgens, perhaps more than any other single person, gave freely of her time both while on the CRL staff and after her graduation in order to help me complete my work in a scholarly manner. All of the early work on the chest was documented by her superb photography. She also taught me the use of the x-ray machine, at which I spent many hours learning the finer points of artifact radiography. Additionally, her efforts to increase the scholarly tone of my work often left the pages bleeding red, but once they "healed" from this cosmetic surgery, they were always much improved. Her time spent in drawing one of the most complicated artifacts from the chest, the intricate grip and other sword hilt pieces, created a masterpiece. Finally, her general support and teachings, borne through her many years of experience at the CRL, were a great boon to me and my project. She has been an inspiration from beginning to end.

Many others helped in major and minor ways to bring about the completion of this work. Karen Jones, Ann Baum, and Kristy Sundberg all helped with the editing or phrasing of certain sections. John Scroggs spent many hours editing my thesis from beginning to end for a graduate level course he was pursuing for his own degree in journalism. Michael de la Cruz, Katie Van Benschoten, Emmanuel Rosas, and Caitlin Sullivan all examined works in other languages for me. Aaron Kemp's inordinate interest in preservation and unrelenting curiosity lead him to spend much time brainstorming and researching certain objects from the chest that, thus far, still remain unidentified.

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# CHAPTER I

## INTRODUCTION

### Historical Introduction

In July 1684 the explorer René-Robert Cavalier Sieur de la Salle left La Rochelle, France, with four ships bound for the New World. With the support of King Louis XIV, La Salle officially undertook a program to establish a colony at the mouth of the Mississippi River, which he had determined a few years earlier flowed into the Gulf of Mexico. The expedition's intention was to create an economic and military foothold in this Spanish sea, an aggressive move not lost on Spanish authorities who would in subsequent years expend great effort searching for the rumored colony. After losing his store ship *le Saint-François* to pirates and stopping at several Caribbean islands, La Salle and his group of approximately 400 people (including a small group of women and children) made landfall on the coast of what would one day be known as Texas. Longitudinal inaccuracy on his charts compounded by latitudinal distortions due to a broken astrolabe caused La Salle to overshoot the Mississippi by several hundred miles (Weddle 2001:XV). In fact, while crossing from the Caribbean north to the Gulf coast he had sailed just out of sight of the great outlet. La Salle's voyage had terminated in a hostile land that was to yield a death sentence for most of his people.

La Salle lost a second ship, *l'Aimable*, as it tried to enter Matagorda Bay in February of 1685. La Salle had mistakenly identified this bay as a branch of the Mississippi River and proceeded to found his colony on its shores. The military vessel *Joly*, too large to enter the bay, eventually returned to France, its mission as approved by the king having only been to accompany La Salle to the site of the new colony. Approximately half of the colonists chose to return to France with *le Joly*, having become disheartened at the poor prospects for the colony's survival. With only its smallest vessel left, the barque longue christened *la Belle*, the little colony struggled forward as La Salle took two multi-month exploratory trips on foot throughout the area. While he was away on the first of these terrestrial journeys in January 1686, *la Belle* dragged anchor during a squall, struck a sandbar stern first, and sank. While most of the crew and a few of the provisions were saved, the ship and most of its contents slowly disappeared beneath the murky waters of the bay. La Salle returned from his exploration to find he had lost not only his means to the Caribbean islands for much needed supplies, but also many of his personal possessions and colonial provisions placed on the ship for safekeeping. With the colony's mortality rate rapidly rising, he decided to take a small party of men, including his brother Abbé Jean Cavalier, his nephew Moranget, another nephew Colin Cavalier, and his trusted man Joutel, overland to seek help from New France in Canada. La

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This document follows the style and format of *The Society for Historical Archaeology*.



Salle, Moranget, and two others were murdered by their own men near the modern-day town of Navasota, Texas. Eventually, the murderers killed each other off or died. The Abbé Jean Cavalier, Joutel, and a few other survivors ultimately made it to Canada and from there back to their homeland.

The remaining members of the colony met with disaster. By 1687 a Spanish search party finally located the wreckage of *la Belle*, still awash in the bay but obviously quickly disappearing beneath its waters. They left the area without discovering the colony. The indigenous Karankawa tribe shortly thereafter attacked the 23 surviving colonists. Five children survived the massacre, four of whom were the children of Lucien Talon and his wife. The Talon siblings and the fifth child, Eustace Bremen, were cared for by the women of the tribe until the Spanish found them several years later. In the end, fewer than 20 out of approximately 160 colonists who remained after the departure of *le Joly* survived the ordeal. When another Spanish expedition found the pitiful ruins of the colony in 1689, no one was left to tell their tale.

### **Focus**

This thesis describes one aspect of La Salle's ill-fated colonization attempt. During the discovery and recovery of the *Belle* wreck in Matagorda Bay, Texas, an intact chest was located among the other artifacts stored in the ship's hold. This chest, casually dubbed as the *Belle* Mystery Chest, was believed to have held a set of tools belonging to one of the expedition's hired workmen. Subsequent excavation and examination of the box revealed a much more diverse set of instruments. Along with a number of tools for general carpentry and coopering (the art of barrel making), agricultural implements, weaponry, cutlery, maritime tools, and miscellaneous other goods were found. Why such a wide variety of items were together in one chest was unclear. The *Belle* Mystery Chest had truly earned its name.

### **Excavation**

In 1995 Texas Historical Commission (THC) staff along with a team of researchers led by State Marine Archaeologist J. Barto Arnold used magnetometer surveys to locate a shipwreck in the soft sandy mud of Matagorda Bay (Texas Historical Commission 1996:2–4). Preliminary artifact recovery included a bronze cannon. Its highly decorated surface featured an armorial device bearing the name of Le Comte de Vermandois, the Grand Admiral of France from 1669 until 1683. All cannon cast in the royal foundries between those years bear his title, and this evidence identified the wreck as *la Belle* (Figure 1), the fourth and final vessel of La Salle's ill-fated venture to found a colony (Boudriot 1992:26; Keith et al. 1997:144–145; Foster 1998). Under the leadership of Project Director Jim Bruseth, the THC fully excavated the find (Site 41MG86) over the course of the following two years.

The wreck was buried in sediment 3.6 meters from the surface in low visibility water. To minimize the difficulty of maritime excavation in such conditions, a cofferdam consisting of two rings of interlocking steel plates was built around the site. Pumps bilged the bay waters and archaeological

examination of the marine site proceeded as a land excavation (Roberts 1997:43). The ship itself, a small frigate measuring about 15.5 meters long by 4.8 meters wide, had, as a consequence of the enveloping silt, been sealed in an anaerobic environment, thus preventing its total decay and allowing approximately 20%–30% of the hull to survive (Locke 1999:75; Grieco 2003:9). As part of the recovery project of *la Belle*, an internet site dedicated to providing details of the ongoing excavation was launched. The internet site was updated every 72 hours and was conceived to satisfy the tremendous public interest in the wreck site. At the time, this was the only known site to offer such extensive documentation of ongoing fieldwork (Hall et al. 1997).



Figure 1. Reconstruction model of *la Belle*. Built by Glenn Grieco of the Nautical Archaeology Program, Texas A&M University. Photography by A. Borgens.

Within and about the vessel's hull more than a million artifacts were found, ranging from the very common lead shot, glass trade beads, and rope to a delicate nocturnal, a small crucifix, and human skeletal remains. These items included an intact chest (Artifact No. 11500). A schematic in Bruseth and Turner (2005:85) shows the chest's location on the starboard side of the main hold, immediately adjacent to two powder and three small lead shot casks (Figure 2). Field notes recorded numerous other items in the vicinity of the chest: a cleat from the main deck, a box thought to have contained red ochre, the

boatswain's cask, a cask of well-preserved axe heads, a "saw horse-like feature" that was actually the cooper's plane, a small cask of lead shot, and a number of concretions (Appendix A). The box was jacketed and removed as a single unit for examination at the Conservation Research Laboratory (CRL) at Texas A&M University (director Dr. Donny L. Hamilton, Professor in the Nautical Archaeology Program of the Department of Anthropology). The laboratory was contracted to conserve the entire collection of artifacts, including the ship itself. Upon arrival at the facilities, the chest was placed in a storage tank of fresh water, where it remained until a comprehensive investigation of its contents could begin (Figure 3).



Figure 2. Chest No. 11500 in situ. Just prior to its removal from the shipwreck. *Photograph courtesy of Texas Historical Commission.*

### **Note on Primary Sources**

La Salle's enterprise to the Gulf of Mexico ended with the deaths of most of his company, including his own grisly murder at the hands of fellow Frenchmen. Fewer than 20 eyewitness descriptions have survived, but these stories form the backbone for historical analysis of the expedition. As the sources vary greatly in length, accuracy, agreement, informant, and type of record, it is critical to briefly describe the texts and the most familiar potential problems and biases associated with each. Partisanship and relation origin must be taken into account when determining the validity of details in an academic work. The authors of the reports of the La Salle venture can be grouped into four main categories: those who returned to France on the warship *Joly*; those who returned to France via Canada; those found by the Spanish living among various native tribes; and finally the Spaniards who saw the destroyed colony and

lost vessels. A few miscellaneous sources, such as an anonymous letter written in Petit Goâve in present-day Haiti and a few pages from *Belle*'s logbook, also provide insight to the failed colony's history.



Figure 3. Chest No. 11500 at the CRL. Top: Moving the chest. Bottom: The chest in a holding tank awaiting examination. *Photography by (top) A. Borgens and (bottom) P. Fix.*

There are four sources from those on the expedition who returned to France with *le Joly*. The Abbé d'Esmanville kept a journal during the voyage to the Gulf. His views seem to have changed

drastically after La Salle mentioned in a private conversation his plans to march on the Spanish silver mines, at which point d'Esmanville lost faith in the leader. He decided to return to France, stating he had been sent to convert the natives, not make war on fellow Christians (Margry 1886[2]:511; Weddle 2001:153–154). In addition, *le Joly's* Captain Beaujeu returned to France with a package of correspondence between himself and La Salle. These letters relate the various orders the captain had been given by La Salle, along with the written discussions he had had with the explorer over various matters. The correspondence between *le Joly's* captain and the expedition leader was at times friendly, but more often contained subtle hostility. Beaujeu demanded La Salle put his orders in writing so there could be no doubt where blame lay for any errors. No complete English translations of Beaujeu and La Salle's correspondence nor of Abbé d'Esmanville's journal seem to have yet been published, though they appear in French in Margry's (1886[2–3]) six-volume history of exploration in the Gulf of Mexico. Beaujeu also submitted to the French government three documents written by La Salle: written charges of desertion against the engineer Jean-Baptiste Minet, an account of the wreck of *l'Aimable*, and his charge against Captain Aigron for purposefully wrecking the ship (Margry 1886[2]:555–563; Weddle 2001:236). Finally, Minet kept the most detailed writing of *le Joly's* passengers. As he later spent time in prison as a direct result of La Salle's complaints against him, his journal has a decidedly anti-La Salle bias. While imprisoned, Minet formulated a list of questions he would have liked to ask La Salle, which he attached to the end of his expedition journal. Nonetheless, his journal throughout this portion of the expedition was very thorough, making it exceptionally useful in spite of the engineer's bias against La Salle (Minet 1987:71–126).

Four accounts come from members who traveled back to France via Canada after La Salle's death. The volunteer Henri Joutel, La Salle's close confidant, kept the most detailed journal of the expedition. His version of events has universally been lauded as the most complete and accurate of all the surviving relations, though historian Robert S. Weddle believes that Joutel may have, at the very least, omitted details in his narrative at the insistence of either La Salle or the explorer's brother, Abbé Jean Cavalier, to whose family Joutel had always been loyal (Delanglez 1938:10–11; Foster 1998:5, 24; Weddle 2001:XVI). A second description of events, rewritten, edited, and published in France in 1691 on behalf of Father Anastase Douay by Father Chrétien Le Clercq has often had its reliability called into doubt (Joutel 1998:112). While exonerating Douay of culpability in the account's honesty, Joutel blames Le Clercq of grave exaggeration and error, mentioning that the details given could not possibly all have been remembered by the Father, whom Joutel never saw keep any personal journal notes (Margry 1886[2]:110). A third description of the expedition is attributed to Abbé Jean Cavalier, though its many blatant inconsistencies are well known (Cavalier 1938). Delanglez (1938:15–17), the original English translator of the Cavalier journal, originally believed “the Le Clercq fabrication” to be largely based on the Abbé's memoirs. Several years later, however, Delanglez brought forth evidence questioning whether

Cavalier ever wrote a memoir on the event, becoming convinced the Cavalier novel was most likely an altered copy of Le Clercq's account (Delanglez 1985). Finally, a frontiersman named Jean Couture at the Arkansas Post where the travelers first stopped on their way to Canada recorded third hand a short account by a man named Pierre Barthélemy. Barthélemy's account has all the problems inherent in a third-hand testimony. He seems to have originally exaggerated his statements, but details easily could have changed between his speaking to Couture and Couture's later oral deposition. The story written by Tonti, an old friend of La Salle's, of Couture's recount of Barthélemy's story is therefore suspect (Weddle 2001:241–242).

Several depositions from Frenchmen discovered living among the various indigenous tribes have also survived. These statements were collected through a series of interrogations conducted primarily by the Spaniards searching for La Salle's elusive settlement. These official depositions were given to Spanish officials by Jean Géry (alternatively known as Jean Jerry, Francisco, Juan Xeri, or Yan Jarri), Jean L'Archevêque (also known as Juan Archecuque or simply Archeveque), Jacques Grollet (Jacques Grole), and Pierre Meunier. French authorities much later interrogated the eldest two Talon siblings, Pierre and Jean-Baptiste. When the Spanish located Jean Géry, an early deserter of the French colony, he was living as the venerated chief of multiple native tribes just north of what is now called the Rio Grande. The Spanish authorities questioned his sanity because he gave two very different sets of answers to inquiries made on different dates and locations (O'Donnell 1936:9–11; Weddle 1991:72). Jean L'Archevêque and Jacques Grollet were discovered after they sent a written plea for help to one of the Spanish land expeditions. L'Archevêque, one of the lesser conspirators in La Salle's murder, gave a guarded account of the explorer's death, though there is little reason to doubt the rest of his statements (O'Donnell 1936:15–18, 21–26; Gilmore 1998; Weddle 2001:227). As for Grollet, a sailor from La Rochelle, France, who had deserted the expedition, there is no reason to doubt the validity of his brief statements either (O'Donnell 1936:18–20, 27). Meunier was present at but not a conspirator in La Salle's death. His deposition generally agrees with the other surviving accounts, though not without the occasional exaggeration (Foster 1998:286–289). The Talon children were not questioned by the Spanish, most likely on account of their age, but nearly a decade later in 1698 the two oldest boys, having been on a Spanish ship captured by the French, were interrogated by French officials just prior to another French expedition to the Gulf region (Bell 1987:225–258). Their account, while valuable, has the dual problem of misrepresentation due to the passage of time and the possibility that, as children, they may have misinterpreted some events.

Other accounts of the La Salle expedition remain in the official reports and contemporary journals of various Spaniards who searched for the colony from 1685 to 1691. The most detailed of these accounts are from Alonso de León, Father Massanet, and Don Gregorio de Salinas from the terrestrial missions and Juan Enríquez-Barroto from the maritime expedition (Enríquez Barroto 1987). Dunn (1916) is an excellent source for reviewing the La Salle episode from the viewpoint of the Spanish searchers, the

subject of which was revisited upon and expanded by Weddle (1973), whose work includes information that had come to light in the 60 years since Dunn's work was published. O'Donnell (1936) provides translations of various reports by Alonso de León, Francisco Martínez, Juan Enríquez Barroto, and Andrés de Pez, while a statement by Don Gregorio de Salinas, who supplied his deposition at the same time as Pierre Meunier, is translated by Foster (1998:283–285).

Weddle (2001:XVI) may have best stated the veracity problem of the firsthand accounts when he wrote, "Nearly everyone who shared in his [La Salle's] adventures and gave testimony thereof felt the need at some point to avoid the truth." Many times the sources differ as to why something was done, even while agreeing that a certain event occurred. Most historians believe the text discrepancies in these primary accounts result from political machinations, where an author changed or purposely "misremembered" episodes to color the deeds and events in a light that either damns or deifies La Salle and his venture. The accuracy of the accounts must be approached with caution, therefore, when creating a theory about the *Belle* chest's own unique history. Fortunately for this study, however, these problems of veracity should have minimal impact for the material culture analysis. The diarists would have little reason to wittingly distort facts about the material culture, such as when Minet mentions the length of a sounding weight (Minet 1987:108). For the most part, therefore, the problem of truthfulness should not be a great concern in reconstructing this particular piece of material history.

## CHAPTER II

### HISTORY OF THE LA SALLE COLONIZATION EXPEDITION

#### Introduction

The great variety of items found within the chest clouds its origins and the issue of ownership. Coopering tools, fishing gear, navigational equipment, weaponry, and a host of other oddly assorted items combined in a seemingly haphazard manner, allowing for no single, simple solution as to how they were gathered in one location. However, the surviving journals, letters, and depositions from the venture's first-hand participants offer a probable explanation for the history of the chest. The following history outlines relevant material from the various memoirs. These historical threads will be joined in Chapter VI to forthrightly explain the most probable circumstances surrounding this hodgepodge of objects. References to items similar to those in the chest, when specifically mentioned by the texts, are generally left to be discussed in Chapter IV, a description of the chest's contents. In this chapter, exceptional focus is placed upon the woodworkers from the expedition, as more than half of the items from the chest relate to their trades.

#### Historical Review

In a letter to the Marquis de Seignelay in 1684, La Salle presented an outline of his expedition plans, including the items he hoped would be provided by the king (Cox 1905:171). Within a section he titled "Notes of What is Requisite for the Expedition," La Salle mentioned such items as "musquet balls of the proper caliber in proportion ... axes, hatchets ... a forge, with its appurtenances, besides the tools necessary for armorers, joiners, coopers, wheelwrights, carpenters and masons" (Cox 1905:187–188). In response to La Salle's requests, the king ordered he be given "hatchets, shovels, mattocks, pickaxes, and spades" along with the "tools for carpenters, joiners, ploughwrights, armorers, masons, and ropemakers," along with a great many other things (Weddle 2001:101). Father Le Clercq's biography of expedition member Father Anastase Douay mentions that La Salle ordered three or four men in each trade be hired from La Rochelle, France (Cox 1905:209). The official contracts for these hired workers were discovered by Weddle (2001:285, Note 15) among the notary files of Rivière & Soullard at the Archives Départementales de la Charante-Maritime in La Rochelle, France. Contract terms were for two or three years, and among those hired were two coopers and eight carpenters or shipwrights/ship's carpenters (Weddle 2001:124). Listed on the contracts were the men's full names, occupations, ages, and hometowns (Table 1) (Weddle 2001:285, Note 15). Le Clercq's dubious manuscript says that "great advances" were made to the artisans, as well as to the families and soldiers engaged for the expedition before leaving La Rochelle, France (Cox 1905:210). However, La Salle would later be sorely disappointed in the choices he



made, having chosen “from the scum of the channel ports and beggars at the church door,” unskilled and undisciplined both, given to mutiny, illness, and general trouble (Weddle 2001:124).

Aside from these contracted woodworkers were at least two other carpenters. A man named Monsieur Debois from La Rochelle, France, was employed aboard *l’Aimable* as first carpenter (Weddle 2001:284, Note 9). Joutel describes the second carpenter, Lucien Talon, as having been a soldier (Joutel 1998:112). Under interrogation by the French government a decade later, however, Talon’s sons stated that their father practiced carpentry by trade (Bell 1987:225). Although Pierre and Jean-Baptiste Talon are surely the more reliable source on their father’s occupation, Lucien may not have been engaged as a carpenter for the expedition but instead hired as a soldier. Regardless, Lucien would still possess his trade skills and with his tools could have proved useful, even if his official capacity was that of a soldier. The argument for the elder Talon having had his tools is further strengthened by the fact that his entire family also embarked with La Salle, and therefore many of their worldly possessions would have accompanied them on the expedition (Bell 1987:211).

Table 1. Woodworkers hired for 1684 La Salle Expedition (derived from Weddle 2001:285, Note 15)

Given Name	Surname	Occupation	Age	Hometown
Louis	Belliard	Carpenter	48	Matha, Saintonge
Francois	Belliard	Carpenter	22	Rochefort
Pierre	Chaigneau	Cooper	26	La Rochelle
Antoine	Chappeau	Carpenter	27	Brouage, Saintonge
Pierre	Couillaud	Carpenter	44	La Rochelle
Francois	Jean	Carpenter	46	Matha, Saintonge
Pierre	La Roche	Cooper	22	Saint-Crepin, Saintonge
Claude	Marcollay	Carpenter	19	Muron, Aunis
Jean	Morel	Shipwright	32	Le Havre
Pierre	Vincent	Master Carpenter	50	Angouleme, Angoumois

Minet and Joutel both provided descriptions of the expedition as it left La Rochelle, France, on 24 July 1684. The four ships in the company were *le Joly*, a man-of-war with between 36 and 40 cannon; *la Belle*, a small frigate of approximately 60 tons with six cannon; *l’Aimable*, a flute of approximately 300 tons used as a store ship; and *le Saint-François*, a ketch of approximately 20 tons. *L’Aimable* carried the bulk of the cargo for the trip, including the provisions, craftsmen’s tools, seven cadets, and 40 hired workers (Minet 1987:84; Joutel 1998:49). The Talon family, probably carrying Lucien’s tools, also boarded *l’Aimable* (Bell 1987:226). Pierre Meunier states that men, gunpowder, ammunition, supplies,

tools, and skilled officers were aboard *le Joly* (Foster 1987:286). *Le Saint-François* had been contracted to hold the remainder of the provisions, including much of the wine, meat, and vegetables, as the other ships were at full capacity (Minet 1987:84; Joutel 1998:49).

A firm count of the number of people that embarked is unobtainable, but the crews of *l'Aimable*, *le Saint-François*, and *le Joly* number 100 persons in total (Weddle 2001:286, Note 28). Approximately 145 passengers then boarded the warship (Weddle 2001:131). Villiers (1931:13), in his study of the expedition, estimates 58 people aboard *l'Aimable*, 16 on *la Belle*, and 240 on *le Joly*, which, along with the 8 crewmen from the ketch, totals approximately 322 people embarking on the expedition. As Weddle (1991:15) sums the group voyaging to the Spanish Sea:

Toward such a destination La Salle took some three hundred persons, including artisans and craftsmen—many of them claiming skills they did not possess—to build the settlement, and a hundred soldiers, drawn from the riffraff of the English Channel ports, to defend it and carry forth the projected conquest. There were also six missionary priests, Recollet Franciscans, whose task would be to convert the natives, and more than a dozen women and children, including the pregnant wife of the carpenter Lucien Talon and her brood of five.

Pirates captured the ketch *Saint-François* just prior to its scheduled arrival at the island of Saint Domingue in the Caribbean. To compensate for goods lost with the vessel, supplies were obtained while anchored in the French-held territory (Joutel 1998:54–55). Joutel asserts that no one had any substantial knowledge of La Salle's business dealings and that no one was appointed to take account of and inventory the goods aboard the vessels, to make sure the leader was not being swindled. A volunteer and friend of La Salle named Monsieur Le Gros apparently knew the most about the explorer's affairs and handled whatever was needed of him. After the business was settled and La Salle had recovered from an illness contracted on the island, the three remaining ships left Saint Domingue on 25 November 1684 (Joutel 1998:57). Once as the vessels stopped en route at a small island to check for fresh water, an Englishman who had joined the expedition at Saint Domingue was accidentally left behind but later recovered. His name was James/Hiems, and he would become a key participant in La Salle's murder (Joutel 1998:77; Weddle 2001:150).

La Salle traversed the Gulf of Mexico and unknowingly came ashore at what the Spanish would soon call San Bernardo Bay (present day Matagorda Bay, Texas), rather than at the mouth of the Mississippi River for which he had planned. His settlement, intended to be a strong French foothold at the outlet of America's greatest river basin system, would instead be located on the hostile Texas coast, hundreds of miles west of the intended locale. La Salle ordered Joutel and some of the soldiers ashore with supplies, including powder, musket balls, bullets for hunting, and casks of wine and brandy (Joutel 1998:80). About ten days later on 2 February 1685, Minet wrote a letter to La Salle expressing concerns regarding the projected placement of a settlement in this location. La Salle apparently answered with a

letter “full of invectives.” Minet defended his position. He believed it his duty to the king to advise La Salle as a professional engineer on the potential problems associated with erecting a colony on the site. Regarding La Salle he said, “There was nothing against him, but this is a man who has lost his mind. I am no less his servant for all that, provided that he finds his river and carries out what he promised” (Minet 1987:103).

Two days later, La Salle ordered over a hundred of the men, including the soldiers, volunteers, and hired men, to march up the shore with *la Belle* following along the coast. He gave command of these men to Joutel and his nephew Moranget, giving them enough provisions to last eight or nine days as well as the necessary arms, utensils, and tools. They left 4 February 1685 (Joutel 1998:81; Weddle 2001:159–160). Joutel viewed these men with little regard, coolly observing that “most of these men had been taken by force or deceit. In a way, it was almost like Noah’s ark where there were all sorts of animals. We likewise had men of different nationalities.” Among the marchers were four of the carpenters. One day when encountering an impassable river, Joutel set them to work on one of the few nearby robust trees in the hopes of making a dugout canoe. As they had only brought two axes with them on this march, the men relieved each other by turn. They were given double rations from the group’s quickly dwindling supply, although this still amounted to very little food. While this project was being undertaken, Joutel simultaneously worked at trying to build a raft from driftwood and vines (Joutel 1998:84–85; Weddle 2001:162).

Meanwhile, La Salle had been summoning Minet to come ashore. Wary of La Salle’s temperament, Minet diplomatically resisted. Using the loophole in the king’s orders by which he was to remain aboard *le Joly* as long as it was at sea, he claimed it his duty to remain on the ship as it had not entered any harbor (Minet 1987:106). On 17 February 1685, he received a third summons in which La Salle claimed he had found his river (the Mississippi) and wanted to begin erecting fortifications. Minet’s thoughts on the matter are clear.

Whom does he want to build a fortification? Does he have masons? Some laborers? He had about 20 hired men [*engagés*], of whom half are dead. Of 100 soldiers there are still 80 ill. With that, what fort does he want us to wall up without bread or water? And the floods (Minet 1987:108).

La Salle, however, bade *l’Aimable* and *la Belle* to prepare to enter Matagorda Bay. As *l’Aimable* was the larger, deeper ship, he ordered the captain to remove many of the heavier items. These items included eight cannon, iron, several thousand lead shot, and Joutel’s own trunk, as it was rather large and cumbersome (Joutel 1998:87). All accounts are in agreement concerning the supplies and tools aboard the ship and that some were removed to lighten the vessel (Foster 1998:286). *L’Aimable* nevertheless floundered in the shallowest part of the channel, where it remained grounded for over three weeks, full of water but not falling to pieces. When weather conditions permitted, the boats would conduct salvage

operations (Cox 1905:215; Weddle 1973:218). Items recovered in the salvage included powder, food, and part of the merchandise (Minet 1987:110). The wooden fort erected on the southern side of the coast was kept stocked with the remaining tools and supplies, according to Meunier (Foster 1998:287). The first fort was abandoned and all its provisions brought to the new one made from *l'Aimable's* wreckage (Weddle 1973:219).

In mid-March, Minet accompanied *le Joly* back to France, along with a number of other people who had become disillusioned with the enterprise as the enormity of La Salle's problems grew more evident (Minet 1987:113–114). Approximately 140 to 170 people remained in Texas. Approximately 45 of these settlers set off with La Salle in search of a permanent location to found the colony. Of the ones who remained under Joutel's watchful eye, he claims several died every day of scurvy and other diseases (Joutel 1998:98). Father Anastase Douay observed that the illnesses the soldiers had contracted at Saint Domingue were killing them at a remarkable rate. Efforts to provide relief through various broths, preserves, treacle, and wine proved unsuccessful (Cox 1905:217–218).

Joutel criticizes the quality of work performed by the artisans and laborers. "It seemed there was a curse on our workers. They had been a poor selection and that was the principal cause of the troubles which we had in this country. Few among them would undertake any labor ..." (Joutel 1998:98). Douay reasserts this claim: "The selection [of workers] was, however, so bad that when they came to the destination and they were set to work it was seen that they knew nothing at all ..." (Cox 1905:209–210). La Salle was also having problems with the workmen he had brought with him to search for the settlement's permanent location. Having briefly visited Joutel's temporary camp to make sure all was well, he returned to his own camp only to find it abandoned. When he found his men, they said that a local tribe, the Karankawan Indians, had attacked them as they were felling trees. As the workers were unarmed and unprotected, they fled the area, leaving their tools behind. Rather than send a group back to reclaim the tools, the men completely abandoned camp. The loss of the invaluable tools angered La Salle. He also feared that the Karankawan Indians now understood how easily the French could be intimidated and that the lost tools would be used as weapons against the settlers (Joutel 1998:99). However, the natives continued to fear the roll of drums that was the call to arms for the Frenchmen, and when they would hear these drums, they would quickly drop to the ground to avoid musket and cannon shot (Weddle 1973:258).

In early June of 1685, La Salle sent a message to Joutel stating that he had decided on the location of the settlement. Joutel was to send all but approximately 30 men to this new location by an overland march exceeding 50 miles. The remaining 30 men were to stay with *la Belle* until it could be unloaded at a staging area set about halfway between Joutel's camp and La Salle's settlement. Approximately a dozen men were employed at the staging area to ferry goods from *la Belle* by canoe to the main settlement. Joutel enjoyed having fewer men in his camp, as he had kept the ones of higher

quality. However, he still had to thwart a coup in which he and Le Gros were to be murdered so that the rest of the men could access the goods that were being kept under lock for safekeeping. Some of the soldiers and hired men tried to desert but were tracked down by Nika, La Salle's Shawnee hunter. Along with the two men who had tried to stage the coup, the deserters were eventually taken to the new settlement and put on trial, although the punishment for such offenses was not noted (Weddle 2001:184). In mid-July *la Belle* arrived at Joutel's camp and all of the goods and possessions were put aboard. The following day Joutel and his men traveled to the staging area, where the cargo was to be temporarily placed. The fortifications were primitive, consisting of only the chests and casks that were stacked about (Joutel 1998:101–102). Survivor Pierre Meunier agreed with Joutel's account, additionally stating that "They used the three canoes to bring the tools and supplies from the other fort, abandoning it" (Foster 1998:287).

Douay mentions that the colonists at La Salle's settlement were building houses (Cox 1905:218). Upon his own arrival, however, Joutel was amazed by how little progress had been made. Half the colony's settlers were dead already, including the unskilled craftsmen who "had inconsiderately died" or lay ill, unable to work (Weddle 1991:28; 2001:186). The logs, though cut and squared already, were lying untouched. "The ignorance of the carpenters was such that La Salle was forced to act as a master builder and mark the pieces of timber for the building design that he had in mind" (Joutel 1998:102). Matters were compounded when the master carpenter was lost while under Joutel's own care.

One evening when I was, as usual, escorting the workers on their return to camp, I strayed off a short distance to pass by some small thickets that were between the woods and the settlement. I planned to kill some birds to bring to the Abbé who had been ill for some time. I had told the carpenters to go ahead, and I expected to find them all at the camp when I arrived. [When I returned], I asked where the master carpenter was and was told that he had not arrived. I was obliged to retrace my steps to see if he had fallen asleep along the way. However, I found no trace of him although I shouted here and there and fired several gunshots for him to hear. I found nothing, which worried me. The night passed without learning anything of him, and the next day we went in different directions to see if we could find him. However, we could not find out where he had gone or what had become of him. He remained lost. I was disturbed by this loss because I was with him; but there was nothing I could do. La Salle told me that I should not have left him, but there was no reason to expect that this would happen (Joutel 1998:103).

In spite of this setback, sufficient wood was eventually gathered to build the first house, and La Salle "laid out the pieces so they would fit, marking the mortises and tenons" (Joutel 1998:103).

While performing this construction work, La Salle remembered the wood that had been squared and left buried in the sand at Joutel's old camp and decided it would now be useful for his building, especially for making the roof. Joutel set out for the old camp, stopping first at *la Belle* to grab some tools (Joutel 1998:103). The trip was successful, although along the way a canoe with two adzes inside was

lost. La Salle measured out all the pieces and cut them to the desired length. “The pieces were closed with dovetailed corners with a good peg so that they would be most unlikely to slip” (Joutel 1998:105). Joutel seems to not have had much hand in the building, as while this was occurring he made several trips to *la Belle* to bring more things back to camp (Joutel 1998:106). Also at this time, near the end of August 1685, Le Gros died.

He left several items, in goods as well as clothing. He also left 900 or 1,000 gold *livres* in gold *louis*. La Salle took charge of these. He then had some of his clothing sold at a valuation to different individuals. He had done the same with the belongings of others who died here including Desloges and Lecarpentier (Joutel 1998:107).

Two weeks later Joutel was sent to *la Belle* with La Salle’s goods, including his clothes and utensils. La Salle wanted to have all of his possessions placed aboard so that he could take the ship farther up the bay to determine whether one of the branches of the Mississippi River emptied into their bay. On this first trip to *la Belle*, strong winds sent waves over the edges of the canoes, filling them halfway and drenching the items in the chests. Shelter was sought on land, and the trunks were unloaded. During the night that followed, the water greatly receded. The canoes were too heavy to carry and the ground too rough to drag it over. “Therefore, we were perplexed about what we should do. We had two trunks which we could not carry, and inside were clothes which we could not leave behind.” They had to remain until the tide returned before they could continue with their trip (Joutel 1998:107–108). Joutel made several more uneventful trips to *la Belle* in the following days and weeks as La Salle prepared to leave on his exploratory journey.

Provisions that had been brought up from the supply dump with great labor were sent back to reload *Belle*: 4,800 livres of dried meat, as well as grease, vinegar, salt, oil, and flour, and six casks of wine (with only a cask and a half left at the fort). Placed on board were ‘all the chests, clothes, papers, utensils, linens, and crockery,’ La Salle’s own as well as those of the ecclesiastics, officers, and ‘particulars’ of his company; all the trade goods; powder, shot, and arms, including cannon; tools, including the forge; two thousand livres of gold; and a servant girl from Saint-Jean d’Angely to serve as laundress (Weddle 1991:29)

In a document later titled *Procès-Verbal Fait par La Salle, Avant de Conduire Son Frère au Mississippi* and dated 18 April 1686, La Salle wrote that, prior to leaving, he had 11 barrels of water placed aboard, along with everything of which he did not have absolute need. The others who were to travel by land with him did the same, even carrying as little ammunition as possible (Margry 1876–1886[3]:543). La Salle was to begin this trip aboard *la Belle* and then continue by land, at which point the vessel was to return to the area of the settlement (Joutel 1998:110). A number of items were left within Joutel’s care, including “some tool chests” (Joutel 1998:111). In the days following La Salle’s departure, the colony’s food

supplies were meager, as even all the smoked meat had been placed aboard the ship for their trip (Joutel 1998:114).

While on his exploratory trip, La Salle never ceased to worry about his possessions. He had placed them aboard *la Belle* in case Joutel and the settlement had been taken by force, fearing the loss of his papers at the hands of natives or their use by a hostile European nation. He told other members of his party that upon his return to the settlement he would have the ship repaired and all of his possessions unloaded at a fort on one of the rivers he had discovered. Weddle (2001:190) comments upon this:

As for the *Belle*, La Salle left her loaded with the necessities of his colony, in the hands of an unskilled crew commanded by a known drunk, with a single anchor of proven inadequacy. Moreover, she stood in an uncharted bay whose shores were lined with hostile natives, on a seacoast already noted for its gusty winter northers. The risks should have been apparent; so should the magnitude of the disaster that was being invited.

When La Salle returned from this trip at the end of March 1686, he found that *la Belle* had not been seen in months. His folly at putting all of his belongings in one place became apparent to him. Hoping that, at worst, the ship had sailed for Saint Domingue for help and supplies, but fearing the permanent loss of the vessel, “he was much more acutely affected by this loss than by all others, since all [his] belongings and apparel were on the ship, as well as all of his papers” (Joutel 1998:130–131).

During his absence more colonists had perished, including the married soldier, Lucien Talon, and his daughter Marie-Élisabeth Talon, and the edge tool maker René Pelle. With the anvil having been left on the ship and using a cannon in its stead, Pelle had been unable to accomplish much (Joutel 1998:111; Weddle 2001:200, 285, Note 15). The Sieur Thibault also passed away. “Before dying, he made a sort of will in which he disposed of a few of his belongings, some to the Recollet fathers and some to other individuals. However, the return of La Salle changed matters.” (Joutel 1998:118). As Weddle (2001:200) states, “The leader, in fact, seemed always to have confiscated anything of value left by those who died.” La Salle also requisitioned various possessions belonging to the Sieurs Duhaut, including hatchets and linen cloth that was then used to make shirts. “Le Salle also distributed the belongings of several deceased individuals including the Sieur Le Gros, Monsieur Thibaut, and Monsieur Lecarpentier.” Property, especially the clothing, was handed out according to its value; individuals of higher rank or position received the items of greatest worth. “Thus everything was put to use to try to get out of this difficulty and effect [sic] the success of the venture” (Joutel 1998:133).

Shortly after La Salle departed on another exploratory trip on 1 May 1686, the survivors from *la Belle* arrived at the settlement. Although delighted to see them, Joutel was dismayed to hear of the ship’s loss. The survivors had only been able to save some of La Salle’s clothes and papers, some linen and glass beads, and 30 to 40 pounds of meal (Joutel 1998:135). Shipboard members had run low on supplies,

especially fresh water, and decided to move closer to the settlement. Unfortunately, there were too few healthy men to properly handle the ship. A north wind drove them off course to the far side of the bay. They cast their one remaining anchor, which dragged, and the ship ran aground (Joutel 1998:136). After finding fresh water on shore, a small raft was used to unload some of the property from *la Belle*. Almost daily trips were made to salvage as much as possible before the ship was totally lost. Eventually a seaward wind increased the waves and rocked the ship deeper into the sand, the water covering all except the poop deck (Joutel 1998:137). Le Clercq paraphrases Douay as stating “All the goods were lost irrecoverably .... They lost thirty-six barrels of flour, a quantity of wine, the trunks, clothes, linen, equipage and most of the tools” (Cox 1905:221). The Abbé Chefdeville took charge of La Salle’s few remaining effects, but upon his return to Joutel’s camp, he had Barbier return to where the survivors had left a cache of other salvaged items. The Karankawan Indians, however, had discovered the hiding place and taken some of the cloth and iron tools, mainly leaving the heavier artillery, sails, and rigging (Weddle 1991:32–33).

Upon his return, La Salle was upset to find that the ship had indeed been lost. Once again he took possession of and redistributed personal property, including many items the Duhaut brothers had brought to trade or barter, such as cloth, hatchets, and knives. “Furthermore, Hurié, on his departure, left to me a portion of his belongings in case he did not return. I showed this document to La Salle, but as he needed these things, he took possession of them, all except a pair of sheets from which I had shirts made” (Joutel 1998:149). Months later on 12 January 1687, almost exactly one year after the actual loss of *la Belle*, La Salle set out to journey to New France to obtain help, accompanied by Joutel and a group of other men. “As all of La Salle’s effects had remained in the frigate,” the hatchets and knives they carried were Duhaut’s. La Salle also took clothes and papers that had been saved from the wreck. Father Anastase Douay, La Salle’s brother Monsieur Cavalier (the Abbé), and the Sieur de Morenget were among those chosen for this final journey (Cox 1905:223). The man Hiems/James, the English sailor who turned out to be a German from Wittemburg, was also among the company (Cox 1905:224).

Within three months, La Salle would be dead, leaving his loyal supporters at the mercy of his assassins, among whom was his personal surgeon Liotot (Nixon 1939:42–46). Desperate to find a way to escape Texas and avoid possible capture by the French or Spanish, the killers formulated a plan which Joutel relates:

On Tuesday, April 8th, three men arrived, namely the Provençal, one of the two deserters, and one of our company, each with a horse, to collect the provisions I had acquired in trade. I learned then of the plan of the murderers to return to the settlement where they would construct a shallop by which means they would go to the Islands [modern Haiti]. But I suspected this was just an idea. To effect [sic] it was another matter: none among them could even produce a model. There were neither carpenters nor caulkers, and, furthermore, they did not have the necessities, scarcely any tools or nails. Everything had been left behind with the ship [*la Belle*]; besides, in the beginning



when we had the tools and the workers, nothing had been made. That was why I did not believe they could succeed. Be that as it may, such seemed to be their plan (Joutel 1998:217).

Each of the conspirators would eventually be killed, mostly by each other. Joutel and a few others, including Douay and the Abbé, successfully made their way back to New France [Canada] and from there to France.

During this time, multiple expeditions had been organized by the Spanish to determine if the rumors of a French colony in the Spanish Sea [Gulf of Mexico] were true. On 25 December 1686, a maritime expedition was commenced by Captain Martín de Rivas in the *Nuestra Señora del Rosario* and Captain Pedro de Iriarte in the *Nuestra Señora de la Esperanza*. Their vessels (*piraguas*, highly-maneuverable craft with one large sail and about 20 oars per side) were manned by crews of about 60, including two carpenters in each (Weddle 1973:92–93). Juan Enríquez Barroto acted as chief pilot on Rivas's vessel. He was known for his draughtsman experience, his practicality as a pilot, and his proven intelligence (Dunn 1916:330). During the voyage he kept a detailed journal, and in April 1687, coming upon the wreckage of *la Belle*, he records, "There were found some large smith's bellows and some other very small ones of hand type, a large cooper's plane, some leaves torn from an arithmetic and artillery book in the French language with a piece of map, from which I conclude that she was a French ship" (Enríquez Barroto 1987:172). A later maritime reconnaissance, led by Rivas again along with Captain Andrés de Pez, found the *l'Aimable*, of which all that remained were "some rotten boards with bolts still in them, some cases of muskets all broken to pieces, and some wrenches covered in rust" (Weddle 1973:156).

Terrestrial expeditions were also engaged by the Spaniards to find La Salle's colony. Two Indians named Miguel and Xaviata, who were friends of the Spanish, reconnoitered the settlement before any of the official missions could reach it. Upon their return, they commented upon the many broken chests within the dead settlement (Weddle 1973:171). When General Alonso de León reached the colony on 22 April 1689, the destruction he encountered was complete: "chests and bottle cases broken open ... pots, drawers, bottles ... many manuscripts and ... books ... furnishings ... cannon ... swivel guns ... harquebuses ... cannon balls ... large nails ... iron rods ... broken wine casks" (O'Donnell 1936:14–15; Weddle 1973:185). In the general's official report to the Mexican Viceroy, dated 16 May 1689, he emphasizes the sacking and death of the settlement, commenting especially upon the numerous broken chests and harquebuses (Weddle 1973:199). Although the settlement would later be returned to and burned to the ground, this is the last word on the physical contents of the colony, its chests, or its tools.

## Conclusions

Descriptions of tools and chests in the various memoirs indicate that they were often relocated, as the preceding abbreviated retelling demonstrates. *L'Aimable, la Belle*, the initial landing place, the supply depot, and the settlement itself were all repositories for these useful items. La Salle had complete control over these and other material possessions in the colony, requisitioning supplies from the Duhaut merchants as well as dictating who would receive the belongings of the deceased, often in spite of final wishes. The expedition, though primarily French, was also comprised of a diverse group of differing nationalists, such as the German/Englishman Hiems/James and others. These points connect to suggest the probable history of this work's intact chest as will be discussed in Chapter VI.

## CHAPTER III

### TAPHONOMY, EXAMINATION, AND CONSERVATION

#### **Taphonomic History of an Enclosed Marine System**

The focus of this thesis rests not in the conservation of the artifact collection. However, the importance of the field of conservation cannot be underestimated. Archaeological conservation not only involves the examination and preservation of artifacts for the future, but also the discernment of what happened to those objects in the past. This, of course, includes information from both before and after deposition, as the life and loss history of an artifact will significantly determine the course taken in its conservation plan. By deciphering the circumstances surrounding an artifact's past, one can properly begin to analyze the collection of remains.

Fortunately, most archaeologists understand this, but there are a mind-boggling number of potential disturbances to an assemblage. Though well-known general principles exist, there is little understanding of the micro-processes that cause one artifact's preservation to differ from another closely associated one. This need for more knowledge extends to the complex processes that occur inside an enclosed archaeological system, such as a box, cask, or amphora. The incomplete understanding of the differences pertaining to these containers can be blamed upon the rarity of finding such complete and relatively undisturbed items. With few exceptions, such as subterranean tombs and Viking burials, terrestrial sites rarely yield unbroken, completely enclosed containers. Although largely dependent on a site's location, many more unmolested marine sites exist in which these types of complete systems can be found, in part due to limited human access to such sites. Of those containers that do survive, many originally contained only one type of material, as is often the case with mercantile shipment finds. Examples of such easily understood systems include barrels of wine, amphorae of olives, or boxes of glass beads. Other systems hold items that vary in form and material, and these are the ones that need a far more detailed conservation examination, as with the case of this chest from *la Belle*.

Three major forces interact to transform an initially deposited system into that found by the archaeologist. These issues can best be termed as A) external environmental factors, B) boundary conditions, and C) internal compositional factors, all of which can then be subdivided into their specific components. External environmental factors include the physical movement of the system, biodisturbance, and the chemical and physical properties of the water. Boundary conditions include the closely related factors of edge tightness, boundary material, and permeability. Internal compositional factors are defined mainly by the amount of empty space and the chemical and physical properties of the items enclosed. Time is the common denominator in this equation. The longer the environmental, boundary, and compositional factors have to interact with one another, the greater the changes will be in a given system. Figure 4 models these factors, many of which are linked quite closely. The three main

components discussed here are the external forces acting upon the barrier, information provided by the internal matrix, and the degree to which the artifacts inside the system are affected by these conditions and by each other.

#### *External Environmental Factors*

For the purposes of this project, an enclosed system is any three dimensional space separated completely from its surrounding environment. Archaeologically, all enclosed systems will be permeable to some degree, even if the permeability is only that of temperature from the external environment. Examples other than an enclosed wooden chest could be that of a pipe where the intake and outtake valves on each end are closed; a complete barrel of salt pork; a latched jewelry box; an unopened tin of hard tack; a cloth bag with the top tied or sewn together; a gasoline jug with the lid screwed on; or the space inside a telescope between lenses. This definition excludes items that were broken before or immediately upon deposition. A box with a broken, skewed lid or a crushed cask from a shipwreck cannot ever be considered an enclosed system for the purpose of exploring its taphonomic history.

Various temporal conditions impact the history of a system. Changes in the surrounding water column in terms of chemical balance and physical properties can especially affect corrosion levels. If an area upon deposition was largely fresh water but is replaced by salt water over time, the corrosion of metals will accelerate. Seasonal changes in the chemical composition of water may affect the system by fluctuations in both salinity and temperature. Heat and heat loss will eventually bring the system into a relative equilibrium with environmental conditions, whether this temperature change be climatic, seasonal, or daily. Depending on what lies inside the system, the effects may be no more than to change the rate of molecular movement, or they may instead alter the magnitude of physical changes on the materials within or even cause chemical alterations.

Waterlogging is another important temporal condition. Prolonged submersion in water causes wood to degrade due to bacterial action as well as hydrological and biological leaching. Water-solubility most easily removes starches and sugars, but mineral salts, coloring agents, tanning matters, and bonding materials also leach out. Eventually, cellulose in the cell walls deteriorates along with the lignin that forms the strength of the wood. As long as some lignin remains stable, the wood retains its shape; however, the loss of the other materials through hydrolysis greatly increases the porosity of the wood (Hamilton 1996:26). This means that a solid wooden container when first submerged may be stable for a long while and can be subjected to much buffeting without any serious consequences. However, the same degree of physical action could easily open the enclosure to the elements as the wood weakens over time.

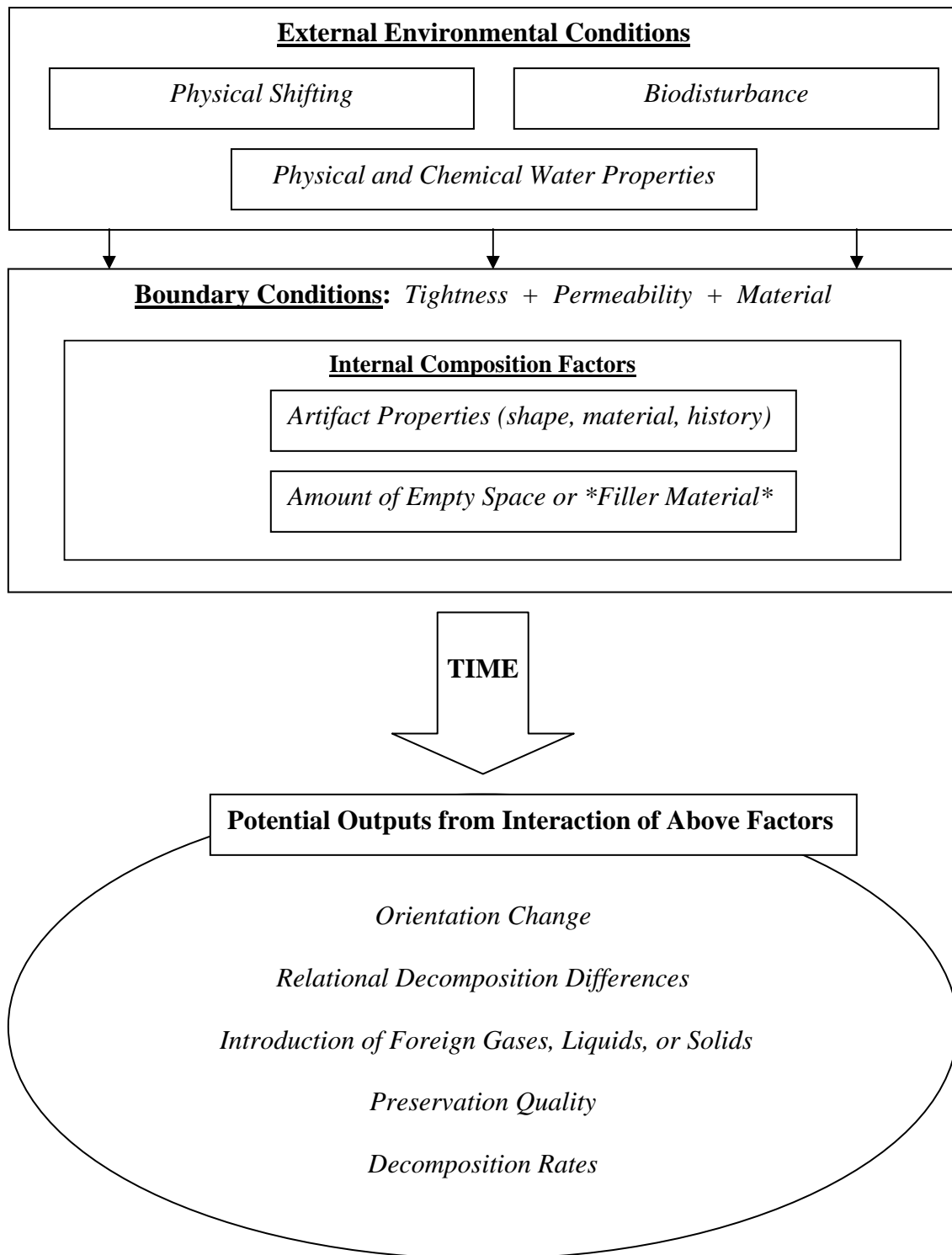


Figure 4. Conceptual model exhibiting the potential processes related to the final composition of an archaeological enclosed marine system.

The absence of boring marine organisms in a buried, anaerobic environment also encourages the preservation of wood. Two of the most common and harmful borers are the teredo worm (also known as the shipworm) and the gribble. The teredo, a worm-shaped mollusk, secretes enzymes that break down and partially digest the wood fibers. The shell's movement scrapes away these fibers. The gribble, a crustacean, gnaws much smaller holes but can still do severe damage to exposed wood (Duxbury et al. 2000: 471). The teredo worm often causes extensive damage in the warmer marine environments where it resides. The wood it attacks is left behind in an extremely fragile framework around the tunnels it bores, usually resulting in the complete collapse of the wood. Other biodisturbances can include movement by invertebrates and growth of seaweed, bivalves, or coral atop the container. A partially opened system could make a great hiding place for an animal and, if carnivorous, the remains of its meals may be found inside as well, much as the remains of raptor or carnivore meals often appear in dry cave deposits and thereby are considered intrusive (Hamilton 2001:234). Through various clues (discussed below), this situation can easily be recognized to determine if and when the system changed from closed to open.

The surrounding water energy and the amount and type of silt into which the box falls are also vital components in the long-term preservation of enclosed wooden containers. Heavy surf damages and breaks boxes open before any major signs of post-depositional process can be permanently imprinted. Boxes deposited in tidal areas may be exposed to daily drying and wetting, which greatly speeds the decomposition of the container. The paramount importance of silt to the long-term preservation of wood means that items quickly buried in an anaerobic environment have a much better chance of retaining their enclosed system properties. A box left in the open on top of a rocky seabed, for example, has a much higher probability of destruction.

#### *Boundary Material and Internal Matrix*

Compared to the many broken containers often found in archaeological settings, enclosed systems are relatively rare, as with the complete chests discovered on the orlop deck of the *Kronan* or the entire toolbox filled with corroded tools from the *Vergulde Draeck* (Green 1977:256, Figures 59–61; Einarsson 1997:213, Figure 4). The way a shipwreck drops most artifacts underwater leads many items to be destroyed during initial deposition. Even if they survive this stage, the processes of time are destructive. How does one go about determining if an open system was an enclosed system for part of its archaeological life, and why is this important? Archaeologists are universally frustrated by intrusion, as this can greatly alter or confuse site interpretation depending on when and how much this has occurred. Intrusions from vastly differing times are usually easily separated out, but the closer in time an intrusion comes to the original deposition, the harder it is to determine its relationship with the period in question. In terms of aquatic systems, several forms of contamination are common, such as pollen (Gorham 2001:283–284). The small size of pollen in the water column allows it to work through even the smallest

of openings in a system. Other micro-contaminants could include small plant remains or any number of minuscule items from other parts of the shipwreck or from subsequent layers of human debris deposited in the area, such as gunshot, glass beads, or fishing weights. Simply understanding the potential for these contaminations is the critical first step to exposing intrusions and determining when the system may have changed from closed to open.

Tightness is an important factor in these enclosed systems because the degree to which materials can enter and exit a system will greatly affect its long-term taphonomic outcome. There are essentially three magnitudes of permeability: that of gases, liquids, and solids. Very few archaeological finds will be impermeable to gases, as it is very rare that items are built to require such a purpose. Liquid permeability will usually manifest itself in the form of water permeability. A further consideration arises when there was a great need for impermeable liquid barriers for mercantile transport purposes. For example, wet casks made by coopers are intended to keep liquid such as wine from leaking out of the system. Ceramic amphorae (with a variety of sealing lid types) up through part of the Byzantine era were also meant to keep internal liquids from being lost. Shipment of these containers in which there was likely to be much jolting and rolling (especially aboard ship) meant that containers needed to be completely and impermeably enclosed. Archaeologically speaking, however, long-term conditions of decay and waterlogged-induced permeability means that these containers will seldom retain their original contents. The smallest damage to a barrier could cause all original liquids to be emptied long before discovery. The tightness of a container for solids is quite different from liquids and gases in that they will almost always be completely excluded from entering or exiting the system. Small particles carried within the water column such as sand or clay/mud particles may partially penetrate the barrier before being stopped, and on occasion some may actually work their way into the enclosure. Loss of integrity around the seams is the most common way for tiny particles to enter a system, and, as will be discussed below, observing the size of the particles and their layers within the system can be an important clue to determining its history.

To use the chest from *la Belle* as an example, the stability of wood in maintaining a closed system is especially important to discuss. Once a box has entered the water, whether as an individual component (such as being pushed off a ship) or as part of a larger unit (within an entire ship that sank), a complex chain of events are set in motion. An airtight wooden box is generally an oxymoron. Although it may retain some air, over time most air will work its way out, assuming, of course, that the box is laden enough to sink to the ocean floor and not float to shore. A box is more likely to be watertight than airtight, but again the likelihood is low as this requires a much higher degree of craftsmanship by a wet cooper for a situation in which it is unlikely to be needed (Kilby 1971:42). The seam around the lid is the most obvious place for water to quickly seep in, though eventually as the container becomes waterlogged the water and dissolved materials within it traverse the semi-permeable wood barrier. The movement of solids like sand, mud particles, or larger objects like pebbles or shells will depend on the degree of fit between

boards or the lid and the container, along with the damage sustained before, during, or after its submersion.

Matrix particle size and depositional layering are the most important points to consider in determining whether or not part of the container was enclosed for the early part of its archaeological life. A multitude of sea forms can find their way into a system, ranging from mud/clay particles, pebbles, and rocks to shells and the remains of other sea life, like fish and crustaceans. Generally speaking, if a system was initially enclosed, only the smallest particles should be found in the gravitational bottom. These waterborne mud and clay particles will create a layer of very fine matrix, and, depending on the size, shape, and orientation of the object, may eventually fill up the entire enclosure, with perhaps only some air or water pockets near the gravitational top or within artifact cavities.

If the system remains unopened, this fine matrix should not change. However, once opened, the matrix can undergo large degrees of change. The size of the particles entering the container will, of course, depend on the size of the opening(s). If the opening enlarges itself only slowly over time, one should be able to see a layering of successively larger particles inside. The addition of these layers will depend on how filled the container was with the fine matrix at the time of opening, as well as how much of that fine matrix may have been washed out by water after being opened. Depending on what is inside, one must also be aware that items could be washed out or destroyed by this sudden action. Fragile items protected by the container may disintegrate upon exposure to outside forces, but items lower down covered by the fine silt may still survive. An example of this would be items wrapped in cloth or paper. If properly buried, they may become extremely fragile but remain present, but at the first sign of disturbance they can disintegrate and not be found. For the archaeologist, this means that some items in the container may seem to have not been wrapped at all when, in reality, everything was until the uppermost layers lost their protective covering at some point in its taphonomic history before being covered again by a matrix.

The history of a site will sometimes be recorded in the concretion layers which are within an enclosed system. Concretion is composed of the corrosion products of metallic compounds. Iron creates the most voluminous concretion matrix around itself. Although corrosion begins as soon as the objects are submerged, the heavy concretion that often surrounds iron objects does not form instantly. This means there is often time for the fine matrix to enter the container. A forming concretion will partially move this matrix, partially incorporate it, and partially form as a layer on top of it. This layering is the most important observation to be made. For containers within a ship's wreckage, there can be much rocking and motion as the ship settles in before the top parts are lost. This motion can be caused by such things as water currents and wave action for those wrecks nearer to shore, while deep sea wrecks will generally settle into stillness much more quickly. Regardless of location, eventually the ship will settle, but strong environmental conditions can still cause movement. A prime example of this would be the effect that hurricanes have on coastal wrecks. They can move incredible amounts of sand and debris, exposing and



moving ships and other items both within and without. Smaller items, if exposed, will, of course, be easier to move around and, therefore, less severe environmental conditions may result in their moving more often. Once a container has resettled, there is likely to be a new influx of small sediment that will land on top of the old concretion layer. At this point, the concretion will again form as before, but it will create a shell over this new layer of mud and sand. Successive layers of matrix and concretion can show how many times a shipwreck may have been exposed and moved before archaeologists find it.

### *Internal Composition*

To understand the final form of the assemblage within an enclosure, the degree of corrosion and breakdown of the various materials used to make the artifacts must be understood. Survival of an object is largely determined by its original composition. The surrounding elements will affect an artifact based on both its chemical and physical composition.

Most non-metallic objects in a marine environment are fairly inert and will usually survive much better than their counterparts on land. Few organic materials leave physical clues in terms of their corrosion or breakdown. The amount of oxygen present will greatly affect the rate of decomposition, in part due to its chemical tendencies as well as its use by aerobic microorganisms that speed the breakdown of organics. Organics will, therefore, survive much better in anaerobic environments. In general, much of the softer material in an organic object will be removed through hydrolysis, leaving only the stronger framework that often becomes quite brittle. Wood has been discussed earlier, and those same problems will trouble any wooden items found inside the system. Rope, hair, and textile (whether of wool, silk, linen, or cotton) are subject to a considerable loss of tensile strength and pliability when waterlogged and can also be greatly affected by the chemical composition of the surrounding water (Hamilton 1996:37). In general, therefore, these organic objects will add little to the specific history of a system but can offer insight into the overall history based on the total degree of decomposition. This is largely in terms of how aerobic the environment was to which the container had been exposed.

Where metal is present, its corrosion is the most important factor in determining the specific events in the history of an enclosed or semi-enclosed system. Although the macro-processes at work in metal degradation are well understood, the micro-processes are still in need of great attention. A metal's corrosion depends as much upon the materials found within its immediate vicinity as upon the chemical composition of the metal itself. This differs from organics, whose degradation is mostly dependent upon inherent qualities, the chemistry of the surrounding water, and the presence of decay-driving oxygen. (They, of course, may be indirectly influenced by the decomposition products of surrounding materials, but the effects are much less profound than in the case of metals.) The following discussion on metal corrosion will necessarily be brief due to the complexity of the subject, but a plethora of sources are available for further information (Cronyn 1990; Hamilton 1996:42–107).

The most common metals in use prior to the Industrial Revolution were iron, tin, copper, lead, silver, and gold. Often these were combined with zinc or tin to form alloys such as bronze, brass, or pewter. Metals will begin to degrade immediately upon submersion, but the rate of corrosion will depend on such factors as the amount of oxygen and chlorides, as well as pH balance and temperature (Hamilton 1996:42–46). The degree of salinity is especially important as corrosion accelerates in its presence. According to Cornet (1970:439), iron will corrode five times faster in sea water than in moist soil and ten times faster than when simply exposed to moisture in the air. Metal corrosion is a process in which ions are conducted away from a metal by electrochemical movement in which electrons are transported from a more anodic (basic) metal to a more cathodic (noble) metal. Simply speaking, metals are ranked in the order in which they are most likely to lose electrons. The “lost” electrons will either be diffused into the water or absorbed by a more noble metal nearby. Even the same metal object can be different in its electrochemical potential from one part to another due to differences in chemical mixing and physical manipulation. Objects that have been subjected to mechanical stress will corrode preferentially along the lines of stress, such as areas greatly worked by an artisan, pounding (such as a nail with a hammer), or other changes such as a bolt bent and twisted in a shipwreck (Hamilton 1996:44). Metal sockets on a tool, which have to be wrapped and worked into a unique shape by blacksmiths, may be more apt to quickly corrode than other, less-worked parts of the same object.

Commonly found metals range from the most basic to the most noble as follows: zinc, iron, tin, lead, copper, silver, and gold (Hamilton 1996:43, Table 1). The placement of alloys within this group will depend on several things, such as the percentage of the metals used. For example, pewter will generally fall between lead and tin, its two most usual base metals. Pewter with higher levels of tin will corrode faster than those items with relatively lower levels of tin. The tin component will corrode first, thereby saving the lead component as it absorbs the lost tin electrons. This process would be accelerated if, for example, the pewter was lying next to a copper item, because the copper would be “stealing” electrons from both the lead and the tin, but this same process would be delayed if it were lying next to an object of iron, as both the tin and lead could maintain themselves by the capture of the electrons lost by the iron. These rules can generally be applied to any metal corrosion process, but the micro-conditions that influence these processes are not precisely understood and every object will be unique in terms of how it corrodes.

The formation of encrustation from the corrosion products of metals is crucial to understanding processes inside an enclosed system. According to Hamilton (1996:45):

As the metals corrode in salt water, there are localized changes in the pH, which upset the equilibrium between the dissolved calcium carbonate and dissolved carbon dioxide in the sea water (Leigh 1973:205). This results in insoluble precipitates of calcium carbonate and magnesium hydroxide. These precipitates intermix with sand, marine life,

and corrosion products ... to form a hard dense layer of encrustation or concretion around the metal.

Most iron objects in sea water will completely change to ferrous sulfide, leaving only a loose slushy iron-smelling material inside the mold. Buried iron objects, such as those found in an enclosed system within a fine matrix, tend toward becoming a fragile magnetite, but will retain surface detail and structural integrity (Hamilton 1996:46). Both magnetite and “slushy” iron artifacts were found in the chest from *la Belle*, giving clear clues to its taphonomic history.

Aside from electrochemical changes that can be slowed by the formation of encrustation barriers between metals, anaerobic sulfate-reducing bacteria play a large role in the degradation of iron and other metals. The bacterial presence allows for the continued reduction of the metals, even when separated from other metals by encrustation and from the water column at the surface of a site. An important consequence of these bacteria is manifested when wood is in direct association with metal. Wood decay uses oxygen, which creates the anaerobic condition conducive to the life cycle of the bacteria and also provides nourishment for the microorganisms. This effect is most prominent with regard to iron, silver, and lead (Hamilton 1996:47).

Most metals are less common but more noble than iron, so these items often preserve better underwater, especially when located near iron objects that tend to electrochemically “save” them. When encrustation forms on these other metals, it is usually much thinner than that which forms around iron objects. In fact, quite often these other objects are found encapsulated in the iron encrustation rather than their own (Hamilton 1996:89). Silver will usually only have thin sulfide surface layers (Hamilton 1996:95–96). Copper and brass (an alloy of copper, zinc, and usually lead) are also relatively stable and will form generally thin encrustation layers (Hamilton 1996:90). Pure tin is rarely found archaeologically but, when present, it is often found converted to a loose powder. Lead will often be relatively stable underwater, and its corrosion products are also relatively thin, but this thin layer will quickly form a protective barrier that will prevent further corrosion. Both tin and lead are susceptible to the same sulphate-reducing bacteria as iron, and, especially in the presence of wood, it will often be found in very poor condition (Hamilton 1996:103).

### **Dissection of the Chest: Methods and Problems**

A wide variety of materials were found within the chest. In some cases, this diversity helped immaculately preserve the artifacts. In other cases, the array created difficult conservation problems. The following section is an overview of the examination and dissection of the chest and the conditions in which the various artifacts were discovered.

### *General Observations*

When the Texas Historical Commission excavation team extracted the chest from the wreck, all six sides were present and intact, with overall dimensions of 64.2 by 31.6 by 32.8 cm. Heavy concretion was visible along most of the edges. Upon examination at the CRL, a multitude of objects of many sizes, shapes, and materials was discovered inside. With this wide range of materials in such close proximity, the corrosion processes in the chest had been complex. In spite of the fullness of the chest, objects still moved and shifted during the deposition phase due to the irregular shape of many of the items. The articles were well mixed within, probably from haphazard packing as well as the motions of the ship while sailing, wrecking, and settling into the sands of Matagorda Bay.

The gravitational bottom of the chest at rest was along the front right seam and it was oriented at roughly 45 degrees with respect to gravity (Figure 5). This, of course, caused a shift in materials from a likely even distribution over the bottom to a tight fit along the front side and right end. A largely muddy matrix surrounded and covered the artifacts early on, while the upper corrosion layers incorporated small amounts of sand. Shells surrounded the shipwreck site, but none were found inside the chest, nor did the system indicate other intrusions with respect to items larger than sand. All of the chest's sides perfectly paralleled their respective opposite sides; neither did the chest's lid appear to have been opened and shut post-depositionally. The only hole was a two centimeter square section in the upper corner on the left side. This injury was probably exacted upon the box during excavation since no larger depositional materials that could have entered through this hole were found inside the chest.

The chest upon recovery weighed over 136 kilograms. This approximates a weight of 2.04 g/cm<sup>3</sup>, or 127.66 lbs/ft<sup>2</sup>—a tremendous weight. A chest full of wood or other organic material with very little concretion would have only weighed a fraction of this amount. The excessive weight of the chest, therefore, indicated the presence of numerous encrusted iron objects inside. Two layers of concretion clearly separated by a layer of fine matrix lay atop the muddier portions of the chest. Up to two more very thin layers may have existed, suggesting between two and four long-term depositional shifting stages. Iron near the gravitational bottom had clearly become magnetite, with the structure and surface of the items preserved. The muddy matrix enclosed very weak, often slushy iron on the opposite side. The varying condition of the iron artifacts based on location indicates that all the contents of the chest were not covered at the same time, with either only a very slow internal depositional history or a history that can be divided into stages. The outside of the chest clearly must have been buried quickly into an anaerobic environment, as no forms of sea life were observed in connection with it except for one shell on the outside surface. While much of the ship and many artifacts were damaged by gribble and, especially, teredo worms, there are no signs whatsoever of the chest being subjected to their presence.



Figure 5. Angle and position of chest as discovered in wreck. The left end with the handle is visible and the top side is facing the orientation arrow.  
*Photograph courtesy of the Texas Historical Commission.*

The internal conditions of the chest varied drastically from end to end, side to side, and top to bottom. As discussed earlier, the two most important factors to artifact preservation inside an enclosed system are the proximity to other artifacts of various materials and the matrix depositional history. The metals within the chest generally corroded in a straightforward manner, based on their original chemical composition. The main metals present were iron, brass, lead, and several thin layers of tin along the bottom. By far, the most common metal was iron, in both quantity and size. Only a few small brass items were present, and the lead items were also small with the exception of a sounding weight (Artifact No. 11500-6). The iron objects were well mixed among these other metallic items. In terms of electrochemical exchange, the large amount of iron present allowed the other metals to be preserved in high quality, such that most looked like new when they were extracted from the chest.

Two parts of the chest had generally very muddy areas, the front right section and the back left corner, sandwiched between the thick outer shell and the firm matrix found in the central portion of the chest. Although the matrix was very similar in texture, the iron remains were in greatly differing states of preservation. In the front right area, iron was generally preserved, albeit in a weak condition. One could find and clean along the edges of the artifacts with little fear of the objects collapsing. The concretion formed a thin layer around the items that could be removed with an air scribe and yet still retain surface detail. Two drawknives (11500-15 and -16), the shackled bolt locks (-30 and -31), and one adze (-14) from this area were largely in this condition. Iron in the opposite corner drastically differed. There, in the back left corner of the chest, part of a carpenter's square (-23) and another adze (-12) were nearly indistinguishable from the surrounding matrix. The outer surfaces were largely unrecoverable and pieces easily collapsed during examination, often disintegrating before they could be fully outlined. The taphonomic history of the chest caused the difference in preservation between these two areas. According to North and MacLeod (1987:78) and Hamilton (1996:46), and as briefly mentioned earlier, buried iron concretions will usually mineralize to magnetite while retaining structural integrity and surface detail. This is what happened in the front right side of the box. However, exposed iron will have more ferro-hydroxide and ferric oxide components, which are much more apt to allow the metal to disintegrate. This is most likely the case in the back left portion of the chest. The gravitational bottom of the chest was covered with the fine matrix of mud particles. The upper section was probably not filled for an extended period, leaving these iron items directly exposed to sea water for a longer period and, therefore, leading to a different corrosion process than the buried iron in the opposite corner.

Heavy concretion often embraced artifacts in such a way that there appeared to be little difference between the item and the matrix. For example, the rope-wrapped seven-pronged iron fishing spear (Artifact No. 11500-27) spanned over three-quarters of the width of the box and just as much of the length (Figure 6). Part extended through the soft, muddy portions while other parts were surrounded by thick, rock-hard concretion. The matrix created two separate problems with this artifact, one with the rope and one with the iron. A piece of rope that trailed along the handle came clean relatively easily, with the soft concretion falling away under excavation tools with very little damage to the fibers. However, the woven sections along the tines were so thoroughly impregnated with iron concretion that, as the encrustation was removed, individual fibers quickly popped up, broke, and disappeared. Along several tines within the muddier side, the rope fibers were just long enough to observe without disappearing, though a clear weaving pattern around the tines could not be distinguished. In the area along the back side, where the concretion was rock hard, the rope disintegrated immediately with very few fibers surviving, only enough to show that those tines were likely wrapped as well. If this rock-hard concretion had completely surrounded the spear, it would have been impossible to determine that the tines were wrapped and woven as they were.



Figure 6. The seven-tined fishing spear in situ. *Photography by J. Swanson.*

The problem with the iron in the spear was similar to that of its rope in that some parts were easily observable and others not. Multiple factors again caused this. First, the object was likely used in the salt water environments in which the ship sailed. The corrosion processes probably began long before the ship ever sank because the spear was constantly exposed to salt water and then repeatedly permitted to dry. This already weakened structure probably sped its decay within the box, especially as it was surrounded by other iron objects, including the padlocks (Artifact Nos. 11500-30 and -31), a sickle (-21), a hatchet (-17), and an adze (-14)—all of which would have quickened the spear's corrosion as they began their own deterioration. The socket of the spear rested mostly among organic items. Below the socket was the large, solid handle of the cooper's axe (-33), directly above and to the front was the rope that trailed from the woven section along the tines, and to the back side of the chest was a layer of concretion and then non-cultural matrix. Although other iron, such as an adze (-12) and the carpenter's square (-23), lay nearby, several centimeters of matrix separated them from the spear socket. With no other iron in the immediate vicinity, this iron socket remained stronger and more easily visible within the matrix than were the tines. Usually the only way to tell the difference between what had been the iron tines and what was the surrounding concretion was to view the white striation marks from where the iron had been within the white homogenous concreted matrix. In sum, understanding the formation processes of the chest greatly aided in its examination. Items within an enclosed system can easily be lost due to the faintness or state of their remains. The spear could have been easily lost if abiding by the simple concept that iron or organics should always "behave" in a certain way in all underwater systems.

### *Examination*

The chest necessarily was kept wet during the examination process to prevent permanent cellular damage to the organic items. Consequently, it was stored in a vat of fresh water with 5% sodium sesquicarbonate to help slow the iron corrosion. Each day the chest was lifted out of the water, set on a platform over the vat, and covered with wet rags (Figure 7). Water was poured over it every few minutes to slow its drying. Air scribes, dental tools, running water, fingertips, intense lights, and magnifying glasses were all used to remove encrustation, delineate artifacts, and generally examine the state of the box.



Figure 7. Lifting the chest out of its fresh water vat for examination. Note the solid internal matrix revealed by the removal of the side boards. From the left, M. West, H. Dewolf, and J. Hamilton. Photography by A. Borgens.

Great care was taken to prevent the chest from drying out, but even the best care puts the wood under high stress as it slightly dries and rehydrates each day throughout its long-term examination process. Therefore, all six sides of the chest were removed to save them from both dehydration damage and accidental physical damage. This left only the solid internal matrix of artifacts, mud, sand, and especially



concretion. Nearly all the artifacts were x-rayed with the Conservation Research Laboratory's industrial machine, manufactured by Northrup Grumman. These x-rays revealed object outlines beneath concreted parts as well as the locations of internal or missing iron workings. The removed sides of the chest were x-rayed, revealing where fastenings were, the size and shape of the hinges, and the location of a non-extant lock, which should have been found encrusted in situ on the chest. This allowed the chest to be oriented to its upright position during the examination process, which meant rotating the box ninety degrees off of its front side, which had been deposited face down within the shipwreck and stored as such in the laboratory. Removing the sides of the box also revealed the internal matrix, permitting one to view cross sections and, therefore, begin to understand how artifact preservation might vary throughout the container (Figure 8). Under other circumstances, this may not always be feasible, but for wood objects such as boxes and casks with firm encrustation inside, this choice allows the conservator the most flexibility in determining how best to delineate each artifact, in choosing the conservation method, and in maximizing the chance of preserving the artifacts inside.



Figure 8. Author using an air scribe to separate the boards from the internal matrix. *Photography by A. Borgens.*

The change in orientation along with the differences in matrix solidity made for a complex examination process. As mentioned, a very hard and often thick concretion encased the objects on the entire back and left sides. A much softer, muddier matrix surrounded the items in the front and on the right, which aided the preservation but also made the artifacts difficult to discern. Objects were tightly packed against the front and the right due to its final resting orientation in the shipwreck, and great care had to be taken to disentangle many of them.

For a number of reasons, a discussion of how the items within the chest were organized seems to be a moot point. There was no true layering and the objects were greatly tumbled in the shipwreck. It was clear that many of the smaller objects worked their way to the front and right sides of the chest as a result of gravity and depositional movement. The many oddly shaped items also do not conform to a rough layering as their relatively large size or awkward shape meant they had to be placed in the chest in whatever orientation they best fit. There is also no question of temporal stratigraphic problems; all items were clearly in the box and clearly a part of the 1686 shipwreck.

In terms of conservation, the awkward state of the iron meant it was usually too solid to clean out cavities and make full casts of the voids left by the corroded items, yet, conversely, not solid enough to remove as units and withstand the process of electrolysis. Based on this examination, an innovative new conservation method had to be created. This process consisted of partial in situ casting, limited in situ rubber mold making and fiberglass reinforcement, and afterward the creation of full rubber molds to make complete replica casts. The steps are here described in full.

Every iron object from the box was unique either in terms of its preservation or its shape; therefore, one had to continually improvise the methodology used for the iron items. Whenever a hole into an iron artifact's cavity was discovered, it was filled with a marine epoxy (Bio-Seal 192, manufactured by TFT). This helped to stabilize the object and was sometimes enough to later allow the lifting of the object as a unit without the need for other reinforcement, as in the case of the smaller carpenter's adze (Artifact No. 11500-12). Most times, however, this epoxy injection was not enough. Encrustation would next be removed from the object as far as was deemed safe, a process that varied greatly between artifacts. Fragility concerns sometimes prevented all concretion from being removed, and this problem later had to be corrected during the full casting process. In many cases one side alone was uncovered and then stabilized before its excavation was continued. A two-part system was developed because the iron was often crumbly and in some cases completely disintegrated upon extraction: the first step was to retain the surface features and texture, and the second step was to strengthen both the artifact inside the rubber mold as well the mold itself, in case the iron completely fell apart. A wall of plasticine was built around the artifact to prevent molding materials from spreading over the entire contents of the box. The artifact surface was wiped or dabbed with acetone to thoroughly dry it. A thin layer of general purpose, self-leveling silicone rubber (RTV 110, manufactured by GE Silicones), approximately one-quarter to one-half centimeter thick, was poured on to form a flexible mold of the exposed surfaces of the artifact. This particular brand of silicone rubber is good, because once a thin skin is formed on the rubber (about twenty minutes, depending on a number of conditions), the artifact can be submerged in water and the rubber will continue to set. Meanwhile, fiberglass strips were cut and soaked in marine epoxy. The fiberglass cloth used was of a very flexible, thin weave so as to conform to the artifact's shape. The same Bio-Seal 192 marine epoxy used for the in situ casting was used with the fiberglass. Experimentation with

non-marine epoxy (Loctite Hysol Resin Epoxy RE2039 and Hardener HD3561) caused the resulting fiberglass shell to turn white and become brittle, even when allowed to mostly set prior to submersion. The fiberglass strips were set on a non-stick surface (such as a cellophane-wrapped plastic tray), and the epoxy was poured on and worked into the weave with a plastic spatula. Depending on the size, shape, and fragility of the item, between four and ten layers of fiberglass were used as a rigid mother mold supporting the underlying flexible RTV rubber mold (Figure 9). As both the epoxy and the RTV 110 silicone rubber hardened, they closely adhered to each other, but, when needed, these could still be later carefully separated. This combination was allowed to set overnight underwater before further work was undertaken on the artifact.

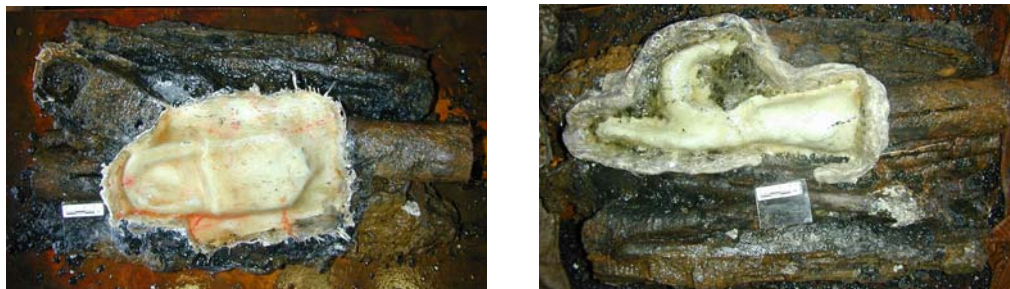


Figure 9. Fiberglass/epoxy artifact mother molds. Left: Large shackle bolt lock (11500-30). Right: Cattle hook (11500-32). *Photography by M. West.*

Depending on the degree of fragility, this mold was sometimes removed to continue work, but frequently was kept on the artifact for protection and to keep the tight seal between the artifact and the RTV, which cannot be reattained once broken. Debris was slowly removed until the object could be carefully levered out. This, of course, created stress on the item and, therefore, breakage was common, but the fiberglass and rubber minimized this problem and usually kept the broken pieces in place, which greatly facilitated later molding and casting work. The rigid fiberglass mother mold also acted as a solid storage unit until the next part of the process could be undertaken.

### **Final Steps: Individual Artifact Conservation**

The assemblage consisted of both metallic and organic items. Many of the woodworking tools were composed of the most common materials, wood and iron. Five lead objects, one of pewter, six of brass, some tin sheeting and silver wire, textile, rope and twine, plant dunnage, and even hair were also discovered. The conservation treatments employed upon each object after its extraction from the chest were as follows in the text below. Further details and variations on most of the treatments described can

be found in Hamilton's (1996) printed conservation manual or the online, updated version of this manual (Hamilton 1998).

### *Organics*

All organic items were generally treated in the same manner. Iron impregnated many of the items to a high degree, so, if the objects were deemed stable enough, they were immersed in a 10% or less solution of hydrochloric acid to remove adhering encrustation prior to beginning the long dehydration process from water to ethanol to acetone. The artifacts had to be dehydrated in this way so that all the water was removed from within the cell walls, but it had to be slow enough so that the exiting water would not pull on and crush the cells, permanently deforming the objects. This is what would happen if a waterlogged object were put directly into silicone oil, because the water rushes out faster than the oil can replace it. After most of the chlorides were removed from the artifacts by deionized water (under 18ppm), the dehydration process was begun by submersion in a solution of 75% deionized water and 25% ethanol. Every six weeks this was changed by 25% increments until the artifacts had been through two complete baths of 100% ethanol. They then continued into a bath of 75% ethanol and 25% acetone, again changed every six weeks until the artifacts had been through two baths of 100% acetone, at which point they were submerged in a silicone/cross linker solution. The silicone polymer portion (80-85%) consisted of approximately 34% SFD-1 and 66% SFD-5. Approximately 15-20% MTM (methoxysilane/methanol) cross linker was added to the silicone oil mixture. After six weeks in the solution, the newly stabilized artifacts could be removed and allowed to drip dry for several weeks (Figure 10), at which point the remaining excess polymer solution was mechanically cleaned and removed with pure MTM. The silicone oil molecules were next permanently joined to ensure long-term stability, accomplished by exposing the artifacts to a catalyst of DBTDA (dibutyltin-diacetate) vapors. A final mechanical cleaning was given to the artifacts to remove any catalyzed polymer or extraneous material. This completed the conservation for the organic items (Smith 2003).

### *Tin*

Several layers of extremely thin tin sheeting were found in the bottom of the chest. Unfortunately, the thinness of these sheets was such that the adhering iron corrosion products made the tin very fragile. As encrustation was removed the tin simply ripped or broke off into small pieces. This made a comprehensive conservation plan unfeasible. In lieu of conventional conservation treatments, therefore, some sections of the tin that were exposed on one side with firm encrustation on the back were simply given a treatment of microcrystalline wax (Hamilton 1996:105). Like lead, the corrosion products in tin do not continue to attack the remaining metal if left unremoved (Hamilton 1996:104). Therefore, bypassing the additional procedures used to aesthetically clean lead was acceptable in this case.



Figure 10. Author removing drumsticks 11500-38, -39, and -40 from silicone oil. *Photography by J. Swanson.*

### *Lead*

The lead objects were the simplest to conserve (Figure 11). There was no visible corrosion or deterioration on the items, and, after extraction, the lead remained extremely stable, as is usual with this material (Hamilton 1996:104). The five lead artifacts were still given a simple conservation treatment to reveal surface detail and to ensure their long-term stability. As suggested by Hamilton and described by Caley (1955), submersion in a solution of 10% hydrochloric acid removed any marine encrustation, lead carbonates, lead monoxide, lead sulfide, calcium carbonate, and ferric oxide. After this surface cleaning, the artifacts were briefly boiled in ammonium acetate to remove potential lead oxides, as well as to buffer the lead from any hydrochloric acid that may have remained within the objects. After a boiling rinse in deionized water, they were submerged in microcrystalline wax to create a barrier to moisture and other contaminants carried within the atmosphere.





Figure 11. All of the lead objects from the *Belle* chest. Photography by J. Swanson.

### *Pewter*

According to Hornsby et al. (1989:15), the chemical properties of pewter are as follows:

Tin is the principal metal used in pewter. Tin is relatively soft and lacks strength, but with the addition of small amounts of other elements it is durable enough to withstand the vicissitudes of daily domestic life. ... Pewter is thus an alloy of tin with other metals ... [F]rom the 15th century the level of lead found is seldom above 25% and commonly below 10%. The other important addition was copper. ... [I]n practice it appears that pewter with above 10% copper is rare and that the more usual quality was about 3%. Antimony ... [and] small amounts of bismuth were also occasionally added. In most cases the top standard required above 95% of tin. ... The second lower standard permitted the use of up to 16% of lead. ... Most pewter was cast. ... Pewter was easy to cast as it has a low melting point. The hardening agents such as copper, bismuth, antimony and, to a lesser extent lead, were added to the molten tin ...

Pewter in the 17th century mainly was composed of tin with low levels of lead. French fine pewter, as the pewter fork from the chest was stamped, was composed of about 95.23% tin and 4.77% lead (Wadley 1985:13, Table 1). According to Carlin and Keith (1997:66) in reference to pewter plates found on *la Belle*,

leaded pewter is relatively resistant to the corrosive action of sea water and the higher the lead content, the more resistant the pewter. ... Pewter can be resistant to corrosion in anaerobic conditions where stable sulphide coatings form on the surface of the artifact and resist further corrosion. But under aerobic conditions, unless it is protected by marine growth and encrusted or buried in the sea bottom, pewter with low lead content can corrode fairly rapidly.

Because the tin is chemically more sensitive than the lead, the chest's lone pewter item, the fork, had to be treated as if it was composed solely of the more unstable material, meaning that the hydrochloric acid method used with the lead objects could not be employed in this case (Hamilton 1996:104). Special care was taken with this object, a three-pronged fork, due to the presence of both a stamped maker's mark and hand-engraved ownership initials. As with the lead, this object was in extremely good shape upon removal from the chest. Rather than risk accidentally marking the soft alloy while mechanically removing adhering encrustation, it was cleaned using electrolytic reduction at a very low current density (2–5 amps). A 5% solution of sodium hydroxide was used as the electrolyte with an anode made of mild steel. The artifact was closely monitored and removed from the solution in the evening, because, should the power have shut off in the night, the high susceptibility of the pewter to the sodium hydroxide solvent could have destroyed the object (Hamilton 1996:105). After a few days, all the adhering marine encrustation had fallen off. The ownership and maker's marks were clearly visible and well preserved. The artifact was then rinsed in deionized water, allowed to air dry, and lightly polished with baking soda. Finally, the object was sealed with two coats of Krylon Clear Acrylic 1301, a spray consisting of 20% Acryloid B-66 in toluene.

### *Brass*

Brass is an alloy composed of copper, zinc, and often lead. Five of the six brass items were extracted from the chest in beautiful condition, as shiny as they must have been the day the ship sank. Only one, the brass leafing on a predominantly iron padlock, was fragile and in an advanced state of corrosion (Figure 12). As zinc is an anodic (basic) metal, even more so than iron, the brass leafing used on the lock may have had an excessive amount of zinc in its initial production, thus instigating the corrosion of what should have been a relatively stable alloy in the presence of so much iron.

The brass artifacts were all put through electrolysis in a solution of 5% sodium hydroxide with mild steel anodes for periods that varied from a few weeks to a few months. After a boiling rinse in deionized water, they were immersed in a 3% benzotriazole (BTA) in ethanol solution for 24 hours to form a barrier between any remaining cuprous chlorides and atmospheric moisture and thereby help prevent bronze disease. Excess BTA was wiped off with an ethanol-soaked cloth and the artifacts were then double coated with Krylon Clear Acrylic 1301.



Figure 12. All of the brass items from the *Belle* chest. Right: The well-preserved brass. Left: The only ill-preserved brass item, the leafing on the triangle padlock. Photography (left) by J. Swanson and (right) by M. West.

### Silver

The silver wire recovered from the chest was used decoratively on a wooden sword grip (Figure 13). As the silver was chemically relatively stable, the entire object first went through the silicone oil stabilization process used on all the organics. As with tin and lead, the corrosion products of silver are also stable and do not contribute to the advancement of later corrosion (Hamilton 1996:103).



Figure 13. Preconservation detail of silver braiding on grip 11500-37 from the *Belle* chest. Photography by M. West.



### *Iron*

The iron objects were by far the most difficult and complex to conserve. As discussed in the previous section, the iron was largely reduced to magnetite and ferric oxide, so many items had to be removed with fiberglass and RTV reinforcement. An epoxy cast of each artifact was created, because no successful method for preserving iron in this state currently exists. The preparation for molding this weakened iron was arduous. Dental tools were often not powerful enough to remove encrustation while the air scribe vibrations would often partially shatter the frail material. Various types of adhesives, including but not limited to 5-minute epoxy (manufactured by Devcon) and Hysol epoxy (Loctite Hysol Resin Epoxy RE2039 and Hardener HD3561) were used to glue pieces back together prior to molding. The typical method used, and that used upon the first molded iron objects from the chest, was to halfway embed the object in plasticine and then build a wall around this bed so that the molding material could be poured in. Unfortunately these objects were generally too weak to undergo this process, because even working with extremely soft plasticine exerted too much pressure on the artifacts, especially on any long or thin items. They would crack, break, and bend, often many times over. Therefore, an alternative method had to be developed.

Accordingly, a wall of plasticine was built around the artifact, with approximately one inch of space between the inside of the wall and the edges of the artifact (Figure 14). The artifact was then removed and a bed of sand placed in the bottom. Depending on the shape of the artifact, it could either be gently nestled into this sand bed, or else placed on top and sand poured around the sides until exactly half of the artifact was covered. The importance of this sand bed being as flat and even as possible was paramount, making the later casting process much easier when properly done. Small cylindrical keys, such as wire nuts or shaped plasticine, were placed at intervals in the sand surrounding the artifact. The depressions created by these keys acted to later align the two halves of the mold during casting. Water was gently poured into this enclosure and over the artifact to wash off any adhering sand grains that would otherwise be visible in the mold. Enough water was poured in so that there was a very thin layer over the sand. The water served two functions. It facilitated contouring of the sand's surface and, most importantly, prevented the silicone rubber from running into the sand and incorporating itself into the mold. After the first half of the mold set, the mold and the clay were removed as a unit, the sand gently washed out from the other side, and the nodules removed. The second half of the mold was then poured. The overall advantages of this method against the use of a plasticine bed are multifold. The procedure is faster to set up, can be used to reduce breakage on weaker objects, keeps the artifacts hydrated, and is less expensive in terms of the amount of plasticine used, potentially an issue when it comes to molding large items. The disadvantages are the difficulty in evenly distributing the sand bed and the possibility of some sand grains becoming a part of the mold and adding unwanted texture to the artifact.



Figure 14. The mold-making process. Left: Adze 11500-14 ready for the silicone rubber to be poured. Right: Example of silicone rubber mold, from which hatchet 11500-17 was cast. *Photography by M. West.*

The composite fiberglass and RTV molds of the iron objects inside the chest often had to be incorporated within the full rubber molds due to the fragility of the iron objects that they cradled. These molds were sometimes all that remained of parts of the objects. The areas where the artifact had disintegrated were filled with plasticine prior to molding. The molds themselves were created from Dow Corning HSIII RTV High Strength Moldmaking Silicone Rubber Base with Dow Corning HSIII 10:1 Clear Catalyst. This particular silicone rubber is preferred because of its set-up time, durability, and ability to replicate detailed surfaces. The use of the composite molds depended upon their positions on the artifacts. If a mold covered exactly half of the object, a full mold could be made of one side of the artifact while on the other side the partial mold was surrounded by the full mold. This combination of the partial and full mold was necessary to later properly align the two halves. In other situations, such as the case of partial molds that retained the shape of a blade, like on the cooper's adze, the fiberglass and RTV had to be carefully cut along the artifact's center line. When the two halves of the full mold were pulled apart, a section of the partial mold would be in each side.

All casts were made of Loctite Hysol Resin Epoxy RE2039 and Hardener HD3561 with Loctite Hysol Dispersion AC5193 (black). This particular brand of epoxy was chosen for its strength, working time (up to 45 minutes), cure time (24 hours), long-term stability, and other desirable qualities. A Dremel tool removed flash lines created during the casting process. To give the cast an aged look, layers of graphite and finely sifted encrustation dust with Krylon Clear Acrylic 1301 created the preferred coloration and texture. A desirable long-term advantage in casting the iron artifacts was the elimination of the long-term problem of storing the iron artifacts in direct contact with their wooden handles. Wood in direct association with iron speeds up the corrosion of the metal, due to the wood's own deterioration using oxygen and creating an anaerobic environment for the metal that then encourages the work of

sulfate-reducing bacteria. The deteriorating wood also provides nourishment for the organisms (Hamilton 1996:47). For conserved artifacts, the remaining tannic acid in the wood may continue the breakdown of the iron.

#### *Final Storage*

All artifacts were sealed within plastic bags and double-tagged with plastic number strips as well as with aluminum tags. The aluminum tags were heat sealed in small separate pockets on the bags so that the metal would not instigate renewed corrosion on the artifacts. As of March 2005, the artifacts are scheduled to be stored and displayed at the Palacios Museum of Palacios, Texas, located on Tres Palacios Bay, an inlet of Matagorda Bay.

#### **Conclusions**

From the moment the chest sank beneath the waters of Matagorda Bay in 1686 until its contents could be displayed at the Palacios Museum in 2005, many chemical and physical changes affected the preservation and conservation of the artifacts. The chest was physically moved, lying finally on its front side. The wood and other organic items became waterlogged, slowly losing their strength, as the iron objects corroded and lost their structural integrity. The seawater had minimal effect on the brass, lead, and pewter items due to the abundance of surrounding iron. The highly concreted chest, brought to Texas A&M University for conservation, had to be meticulously examined and dissected lest any of the now very fragile items be lost. Slowly, iron was separated from wood, the organic items were sent through the silicone oil process, and items that could be strengthened with electrolytic reduction were done so with that procedure. Iron objects were molded, and eventually wood was reunited with the epoxy replicas. The artifacts, formerly useful items on dry land, are once again able to remain in the dry air, out of the watery environment in which they existed for nearly 325 years.

## CHAPTER IV

### ARTIFACT DISCUSSION

#### Introduction

The following chapter describes the various items found in the *Belle* chest. Artifact summaries, measurements, additional illustrations, and bibliographic sources appear in Appendix B. To avoid unnecessary repetition, information on the ships mentioned below is given in Appendix C, including vessel name, type, nationality, location and year of sinking, and bibliographic reference. Several sources are also referred to repeatedly in this chapter. Diderot's (1966) mid-18th-century *Encyclopédie* illustrates a number of items as used by French artisans within the century after the sinking of *la Belle*. Kenneth Kilby (1971) was a cooper for his entire life, as were many members of his family for several generations. He is considered an authoritative voice for information on the art of coopering and the tools of that trade. The following citations also recur and offer especially close comparisons to the *Belle* chest either chronologically or geographically. A large part of the city of Port Royal, an English colony on the island of Jamaica, was destroyed and buried underwater in an earthquake in 1692, only six years after the loss of *la Belle* (Hamilton 1984). Archaeologists and historians have completed considerable excavation and archival work for Port Royal. Additionally, *le Machault* was a French convoy vessel that sank in Chaleur Bay, Canada, in 1759. Many of the artifacts recovered from both of these excavations closely parallel those from the *Belle* chest.

#### The Chest and Its Contents

##### *Chest (11500-1, -54)*

The *Belle* chest was constructed of 10 separate pieces of wood (Figures 15-17). The six sides consist of four rectangular boards and two square end pieces. There is a vertical cleat on each of the two square end pieces positioned so the ends are flush with the bottom edges of the boards. Rope ringlets must have once passed through these acting as handles, as in the case of the late 18th-century tool chest belonging to Benjamin Seaton (Tools and Trades Historical Society 1994: 27–28, Figures 3.3–3.4, 3.6). The lid of the *Belle* chest is longer than the rest of the boards, and two long thin rectangular pieces of wood are attached to the underside at each end to allow for a more snug fit with the boards below when closed. Each piece of wood is attached to the others with three short nails, with the exception of the cleats, which have one nail on each end. Two small hinges attach the lid to the back board. There is also a plate lock mechanism, which will be further discussed in the section on locks below.

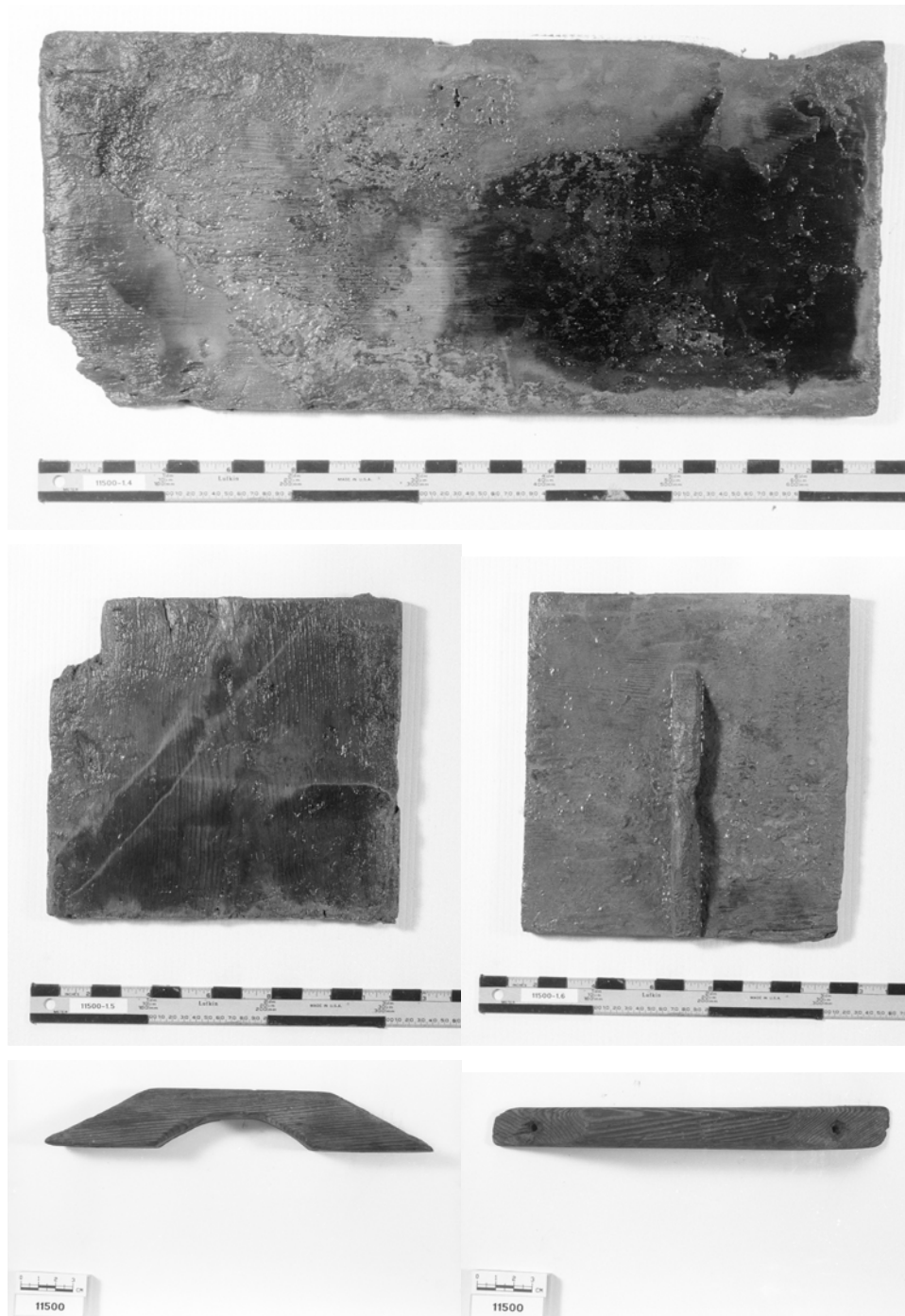


Figure 15. Front and end boards of the chest. The plate lock remains are located near the upper center section of the front board. The right end piece with handle still attached is correctly oriented with the handle flush to the bottom edge. The handle shown in two views is from the left end board. (Preconservation). Top bar = 1 inch, bottom bar = 10 cm. *Photography by A. Borgens.*

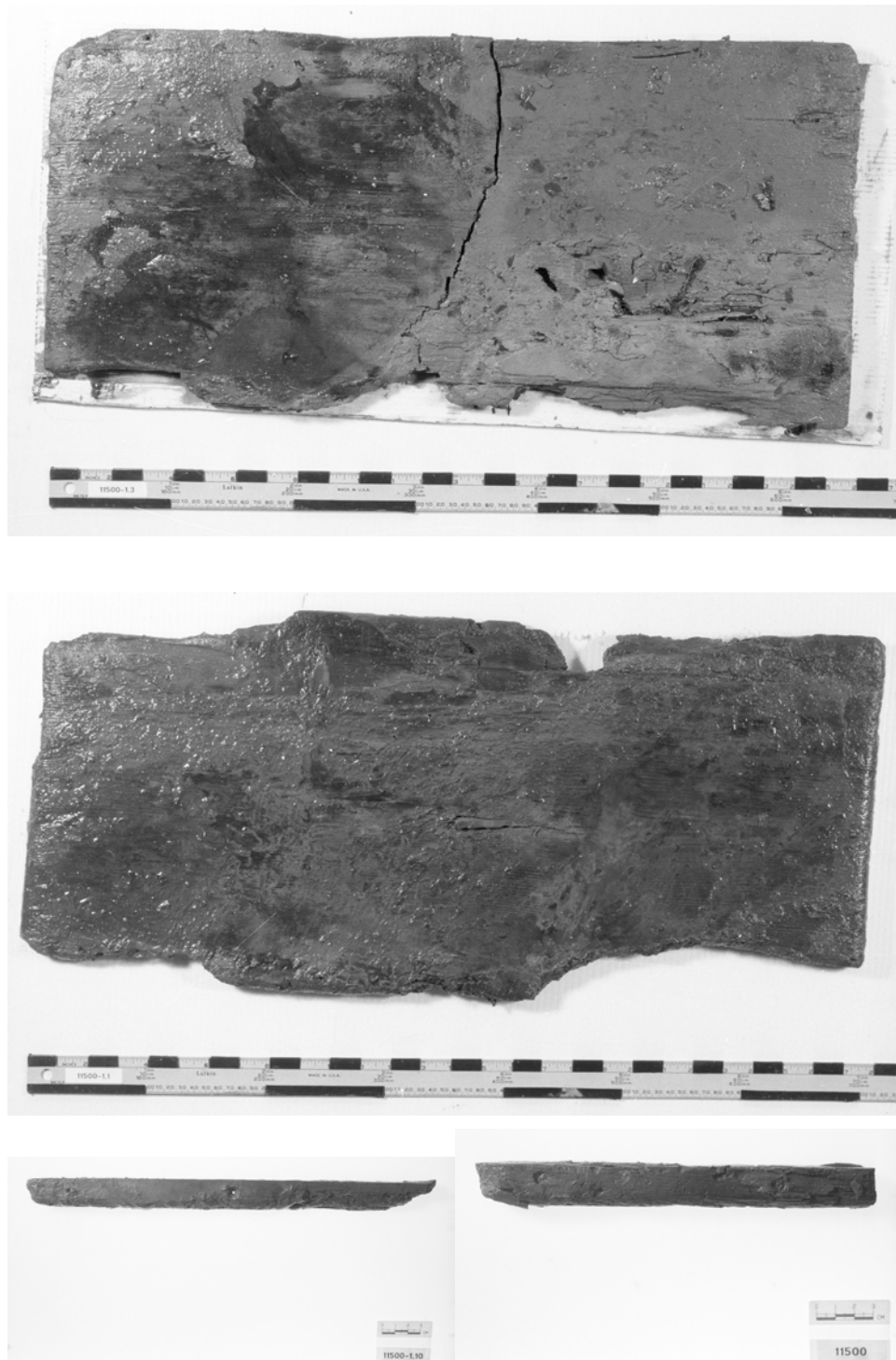


Figure 16. Bottom and top boards of the chest. The two thin pieces of wood were attached along the short ends of the top piece to better seat the lid when closed. (Preconservation). Top bar = 1 inch, bottom bar = 10 cm. *Photography by A. Borgens.*



Figure 17. Back board of chest. This side was facing upward when discovered in the wreck. (Preconservation). Top bar = 1 inch, bottom bar = 10 cm. *Photography by A. Borgens.*

In the latter half of the 17th century, closets as known today did not exist, but there was still a need for storage, whether in a house on land or in a ship at sea. Storage, especially for personal items, was provided by chests, trunks, and chests of drawers (Thornton 1992:113; Richards 1997:87). The single chest that lies at the heart of this thesis consisted of a wooden box filled with items meant to be both stored and transported. The chest could have also served as a seat, a small table, or even part of a makeshift fort as once used by the *Belle* colonists (Richards 1997:87; Joutel 1998:101–102). Based on the contents of a large number of chests and trunks listed in the Port Royal probate inventories from this period, Thornton (1992:114) concludes that the term *trunk* usually referred to a larger utilitarian piece, whereas the term *chest* referred to “a smaller decorative receptacle for personal possessions such as money and jewelry, or specific items such as soap or guns” (Thornton 1992:114). The *Belle* chest and its contents could perhaps fall into either of these categories. Several layers of tin sheeting were lying against the bottom of the *Belle* chest as well. This indicates that this receptacle may have been either a sea chest or a tool chest.

Many studies of archaeological chests focus on the contents, but few focus on the containers themselves. A large crate lid recovered from the *Machault* wreck consisted of a single piece of oak measuring 130.6 by 53.5 by 2.2 cm, nearly twice the size of the lid from this study (Sullivan 1986:28–29). The container had been fastened with nails and reinforced by two iron straps. Excavations at the Swedish Jutholmen wreck site, dating to around 1700, produced a nearly complete chest filled with iron objects and believed to have originally been part of the ship’s fixed equipment (Cederlund and Ingelman-Sundberg

1973:320, Figure 13). A thorough study of the chests from the 1545 English wreck of the *Mary Rose* is an exception, however, to the dearth of information on archaeological chests. Unfortunately, as with the *Belle* chest, the iron fittings did not survive on any of its containers. The hinges, hasps, and locks had to be inferred from corrosion stains, rebates in the wood, and fastener holes. The *Belle* chest appears to most closely parallel the *Mary Rose* Subtype 2.1. This subtype has six simply crafted sides, curved and vertical wooden handles on either end for passing rope through, and few nails used in its construction. The main difference between these two chests lies in the type of hinges present as well as the lock hasp. The wood was notched on the same board in which the lock was inset on the *Belle* chest, more reminiscent of the *Mary Rose* Subtype 2.9 or 2.10, as opposed to the lid notch in *Mary Rose* Subtype 2.1 (Richards 1997:88–91, Figures 7, 9–10).

Four chests were associated with the ship's carpenter's cabin aboard the *Mary Rose*. Archaeologists determined that one chest was primarily for storing the carpenter's clothing and another for keeping his valuables, which included two ash handles probably belonging to gimlets. A third chest contained oak off-cuts, lead sheets and ingots, rulers, planes, a tinder box, knives, a possible pick, and many more ash tool handles. Unfortunately, many of the iron components did not survive, so their exact nature has been lost. The fourth chest, located just outside the carpenter's cabin, contained planes, a caulking mallet, axes, another tinder box, and more ash handles. These last two containers were Type 1 chests and therefore had no lids. An additional chest, belonging to the pilot, contained a leather pouch, a carved boxwood knife sheath, copper aglets, probably clothing, a gimbaled compass, and, nearby, though not actually inside the chest, two pairs of dividers and a case to hold them both. A different chest of the simple Type 2.1 with rope handles, the only one found outside the carpenter's cabin, contained a grooming kit, tool handles, and a leather flask. Yet another chest probably contained clothing and the remains of a sword and leather scabbard. Combining the research on chest types and contents, Richards (1997:94–97) concludes that

an open, lidless chest was designed for storage of necessary materials, tools, or equipment, thereby keeping essentials to hand and the ship tidy. [With locked chests] the owner could stow his belongings and ensure he has sole access by means of a key. Ordinary mariners and soldiers serving on the *Mary Rose* were likely to only have possessed the clothes they wore, in addition to any meager items that could be carried about the person. These men would not have needed or afforded to own a chest. Only individuals with wealth and status in the shipboard hierarchy would be likely to own enough items to warrant storage, afford the purchase and transportation of a personal chest, and command the use of limited deck space on board a crowded warship.

#### *Dunnage (11500-2)*

Dunnage is the loose packing material used to protect the contents within a container. Only a few small pieces of dunnage were recovered from the chest, no more than three dozen pieces of grass of less



than 3.0 cm in length. These pieces are most likely the remnants from a previous packing, since their usefulness as cushioning would have been negligible. Conversely, the pieces may have blown into the chest at some point if it had been left standing open. The grasses could also have been loosely attached to unclean items as they were placed in the container. Of all the tools, the two reaping hooks (Artifact Nos. 11500-21, -22) are most likely to have had plant material still adhering to their blades. Otherwise, any tool set in wet grass could easily have carried small, loose pieces of grass into the chest.

#### *Locks (11500-30, -31, -47)*

Four locks are associated with the *Belle* chest, including its own plate lock attached to the exterior surface and three padlocks found loose inside. The iron plate lock on the *Belle* chest had deteriorated and was recognizable only by its four attachment holes in the board's interior and the corroded remnants in the board's exterior lock recess (Figure 18), but visualization of lock features was enhanced by x-ray. Fastener holes for a strap that would have been aligned with the lock were discovered on the top side. However, there was no sign of the strap having corroded away, so it was likely not present on the chest when the ship sank. Additionally, at least one corroded nail was identified going down through the lid and into the top edge of the front board. The location of a possible parallel nail on the other side of the lock was missing from erosion. It is likely that the chest's lock was therefore no longer in use and at least two nails were holding the lid closed as it lay in the ship. Attached box locks, as opposed to padlocks, seem to be rather rare in the archaeological record, probably because of the exposure an iron lock receives on the outside of a box. The 1852 wreck of the *Eglinton*, however, did produce a rectangular brass lock plate measuring 6.1 by 4.3 cm. It was attached to its chest with four countersunk screws, each 0.4 cm in diameter (Stanbury 2003:135).

Probate inventories pertaining to the estate of John Philpott (Appendix D), a blacksmith by trade at Port Royal, list many types of locks in use in the late 17th century, though unfortunately there are no corresponding illustrations:

bambury stock locks, spring locks, plate stock locks, stock locks, bastard bambury locks, chest locks, box locks, swallow bowed chest locks, sea chest locks, plaine cubbard locks, keyed till locks, pew locks, iron rim locks brass knobs, iron rim locks in a shute, double spring locks, single spring locks, spring latches, plate bolts, outside chest locks, scritore locks, round and splenter locks, pad locks.

Stock locks were used for outside doors, spring locks for inside doors, and trunk/chest locks or padlocks for trunks and such furniture (Thornton 1992:163–165, Figure 42). Philpott may have called the locks found in this study's chest by one of the names listed above.

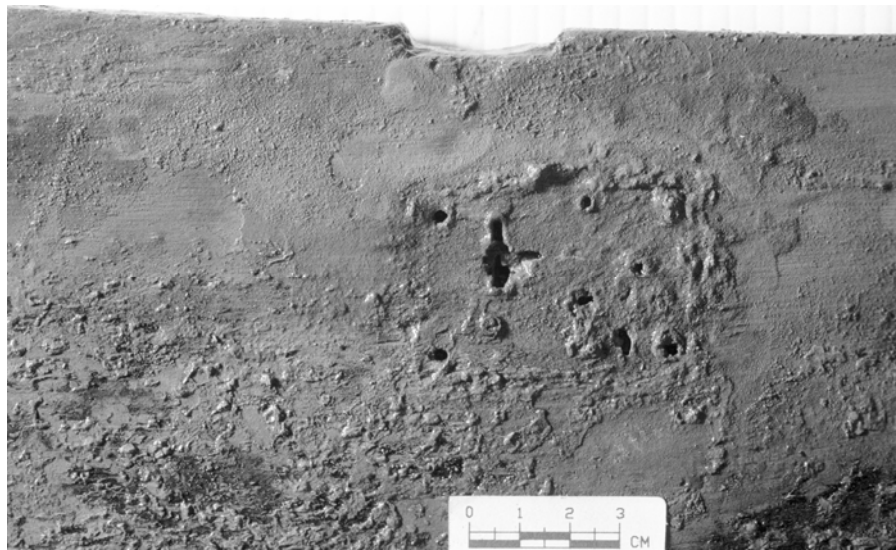


Figure 18. Detail of front board of chest, showing recesses into the wood for the iron lock. (Exterior surface, preconservation). *Photography by A. Borgens.*

The two shackled bolt locks essentially resemble large padlocks with pentagonal bodies (Figure 19). The bodies, however, flare out on the backs into flat square plates with holes for attachment. One of these locks is smaller than the other. Rare shackled bolt locks from the 14th–15th centuries are illustrated by Eras (1957:83, Figure 142). Although much more ornate than those from *la Belle*, it is still the only example that was found by the author with the padlock and flat sheet backing formed from a single piece. Another padlock with its complete internal workings was recovered from the 1733 *Flota* wrecks. Although it does not have the flat backing plate, the general shape and the internal mechanisms appear to be similar (Skowronek 1984:90, Figure 39).

The fourth lock is a small triangular padlock made of iron with brass leafing. Two types of padlocks prevalent in the 17th century used a sliding bolt to engage the hasp. These padlocks came in two forms: one with a triangular shape, the other a more common ball padlock. These locks seem to have been made primarily in Germany in the 15th and 16th centuries, reaching England in the late 1500s and America early the following century. These were generally small triangular locks, with body lengths no longer than 6.4 cm (Noël Hume 1969:250, Figure 79). The remains of one other triangle lock from *la Belle* (Artifact No. 4374) were recovered and cast. Additionally, an encrustation discovered at the *Sea Venture* wreck site contained an iron ball padlock similar to that described by Noël Hume (Wingood 1982:345, Figure 19). A modern padlock collector's handbook also shows a triangular lock with features similar to the one from the *Belle* chest. Although the style is different, the basic components appear to be the same (Arnall 1996:158, Figure 38). Additional triangle locks are illustrated in Eras (1957:48, Figure 65) and especially in Diderot (1966:*Serruriere*, Figure 28), though this last example appears to be

completely of iron. A nearly identical padlock was also recovered during excavations in the 1980s at Port Royal (D. Hamilton, personal communication).



Figure 19. Larger shackle bolt lock. (11500-30). Left: In process epoxy cast of lock. Right: Lock as removed from chest. *Photography (left) by M. West and (right) by J. Swanson.*

#### *Fork (11500-42)*

A single pewter fork from the chest consisted of three tines, two of which bent inward toward the center tine (Figure 20, left). Its finial was trifid-shaped and was marked on the reverse with a maker's mark stamp and inscribed ownership initials. The maker's mark consisted of a crown above a pair of shaking hands. Beneath the hands was the word *FIN*, and above the crown were the letters *M CARDIN* (Figure 20, right). The ownership initials are roughly scratched into the pewter and are difficult to interpret, but they are likely *IO* or *JO*. Although many pewter objects such as buttons, spoons, and a large number of plates were found aboard *la Belle*, the wreck failed to yield any definite pewter forks other than the one found in this chest (Carlin and Keith 1997:66).

The first recorded use of the fork in France comes from 1533 when Catherine de Médici, daughter of the ruler of Florence, traveled to Paris to marry Henry II. Although many Frenchman initially found the utensil ridiculous, the use of the fork eventually spread from the royal court to wealthy homes throughout the rest of France (Giblin 1987:47). By the end of the 17th century, it was commonplace for

the elite to purchase matching sets of flatware (knife, spoon, and fork, usually of silver) to set their tables, but it was also customary for dinner guests to provide their own set (Boger 1983:16; Giblin 1987:52–53). By 1750, forks were no longer seen as a luxury in most parts of Europe (Bailey 1927:14).



Figure 20. Pewter fork. Left: Back side. Right: Detail of maker's mark. *Photography by J. Swanson.*

The earliest type of fork had two tines, but this design remained in use even after the three- and four-tined varieties were introduced. The contemporaneous use of these three varieties, therefore, negates the use of prong count as a diagnostic tool for dating forks (Bailey 1927:7). Some late 17th-century wood and iron forks have tines that are slightly bent, a form initiated by the French. This bend along with the introduction of a fourth tine is indicative of the fork's evolution toward the dual role of scoop as well as skewer (Boger 1983:17, Figure 30). A 1681–1682 Parisian fork and a late 17th-century Augsburg-made fork, both of engraved silver gilt, display four tines and a trifid (Bailey 1927:XLIX–L, Figures 64–65). The Metropolitan Museum of Art has at least two sets of forks dating from the final decade of the 17th century. One set of twelve four-pronged forks (18.73 cm in length) from England *circa* 1690 exhibits a change away from the strict trifid feature to a more fluid version of this shape. The second set is a pair of two-tined dinner forks from London dating to 1697. They measure 19.05 cm in length (Hackenbroch 1969:Figures 69, 71). Both sets exhibit a trifid similar to the *Belle* chest fork. This trifid shape suggests a manufacturing date between the late 1660s and 1700 (Hamilton 1992:359). English pewter before 1692, particularly for flatware as relates to Port Royal, is discussed by Shirley Gotelipe-Miller (1990:8–51) in her 1990 master's thesis *Pewter and Pewterers from Port Royal, Jamaica*.

A number of forks dating from the late 16th century through the early 18th century have been recovered from archaeological sites. The late 16th-century Spanish wreck of the *Girona* yielded 45 forks, including one whose preserved remains appear identical to the *Belle* chest fork (Sténuît 1972:Figure 20).

From the sunken city of Port Royal, Jamaica, a number of pieces of flatware were recovered. The *Belle* fork is similar in form to the one silver fork discovered at that site, although that fork only had the two outer tines (Thornton 1992:94, Figure 17C). The *Belle* fork's finial also resembles features of Wadley's (1985:39, Figure 3) pewter spoon types D and E. Additionally, two forks were discovered by the *Whydah* recovery efforts. One consisted of two iron tines, a pewter collar, and a wooden handle. The other was a four-tined pewter specimen with a flat hammered stem measuring 14.8 cm long and 1.2 cm wide across the tines. On the back of the fork were the maker's mark and ownership initials (Hamilton 1992:359–360, Figures 226–227). A partial four-tined silver fork was also recovered from the 1733 *Flota* wrecks. The tines measured 3 mm in width and were spaced 2 mm apart (Skowronek 1984:49, Figure 5.A). Diderot (1966:*Potiers d'Etain*, Figures 116–119) illustrates a pewterer's mold for a four-tined fork, along with a profile of the completed fork.

Many pewter objects are stamped with a maker's mark. The final task in the making of a pewter object was for the pewterer to add his mark, also called a touch. This mark, containing the name or symbol of the maker, had to be registered with the Guild when he became a master (Hornsby 1989:16). Although it is difficult to date pewter precisely by the type of mark it has, generally the mark became larger and visually more complex during the 17th century (Hornsby 1989:46). A general history of pewter through the early 17th century is provided by Sara Brigadier (2002:83–94) in her 2002 master's thesis *The Artifact Assemblage from the Pepper Wreck*. The maker's mark on the *Belle* fork reads *M CARDIN*. Michel Cardin was a pewterer in La Rochelle, France, in the latter part of the 17th century. In 1691, new laws reestablished the tax on pewter, which previously had briefly been in effect between 1674 and 1676 (Dourhoff 1958:9). The additional stamp “de la marque” was required on all ware, showing it had been properly taxed. The number of pewter tax officials in a given community became a function of the number of masters in that community. In 1691 when these new laws were enacted, Michel Cardin was given the authority to act as one of the three marks officials in his city. Upon his death in 1707, his wife, Elisabeth Menuet, retained this authority, as would often happen if a husband's death preceded the wife's passing (Tardy 1959:371). Cardin's fork recovered from the *Belle* wreckage is also labeled as *FIN*, meaning fine pewter. To be distinguished as *FIN* pewter, 112 parts tin to 26 parts copper were required. This pewter was of a high quality that only master pewterers were permitted to make (Tardy 1959:12).

The ownership initials marked on the fork are most likely *JO* or *IO*, or perhaps even *LO* or *OT* (Figure 21). Monsieur Oris (or Ory) is the only man on the expedition known to have a last name that begins with *O*. Along with several other men, Monsieur Oris was described by Joutel as one “of the most reasonable and resolute volunteers” (Joutel 1998:84). Oris died early in the expedition, having been killed in his sleep during an Indian retaliation raid on the night of 5 March 1685. At the time of the attack, he was a member of a small group returning to the main camp after they had stolen blankets, canoes, and skins from an Indian village. La Salle was upset by the incident, but his attitude on the matter was that,

“after all, it was their fault and contrary to what had been advised: caution and vigilance,” by which he was referring to the fact that no guard had been set that night (Joutel 1998:93–94).

Due to several other parallel markings on the fork, it is believed that the cross piece of the letter *T* is actually an accidental marking, and therefore the letter should be read as an *I* or similar letter. However, twelve names from the expedition survive that have a last name beginning with a *T*. Of these, 10 have first names that do not correspond to these letters. The other two names belong to the volunteer Thibault and a soldier named Turpin, neither of whom have a first name that has survived (Appendix E).



Figure 21. Maker's mark and ownership initials of pewter fork. Shows the maker's mark of clasped hands beneath a crown and the words *M CARDIN* and *FIN*. Below are the ownership initials. Photography by M. West.

#### *Sword Hilt and Chape (11500-3, -25, -36, -37)*

Four artifacts related to a sword were recovered from the chest. A brass chape (Artifact No. 11500-3), used at the end of a scabbard to protect the tip, consists of a single piece of brass rolled into an oval cone-shape with a small sphere of brass on the end (Figure 22). The other three pieces were partial components to a sword hilt. A brass knuckle bow (Artifact No. 11500-25) has an acanthus leaf pattern and



a small decorative knop at the guard end (Figure 23). The small brass guard (Artifact No. 11500-36) also is decorated with an acanthus leaf pattern and has dots impressed around the edges on both sides (Figure 24). The short wooden grip (Artifact No. 11500-37) has 34 large braids of silver twining surrounding it, with three small rolls of twining between each of the large braids (Figure 25). Although these pieces were found scattered throughout the chest, they can be reassembled. A few small markings that cross from the knuckle bow onto the guard verify that these pieces originally must have been part of the same hilt. A pommel is the only major component missing from the chest's hilt pieces.

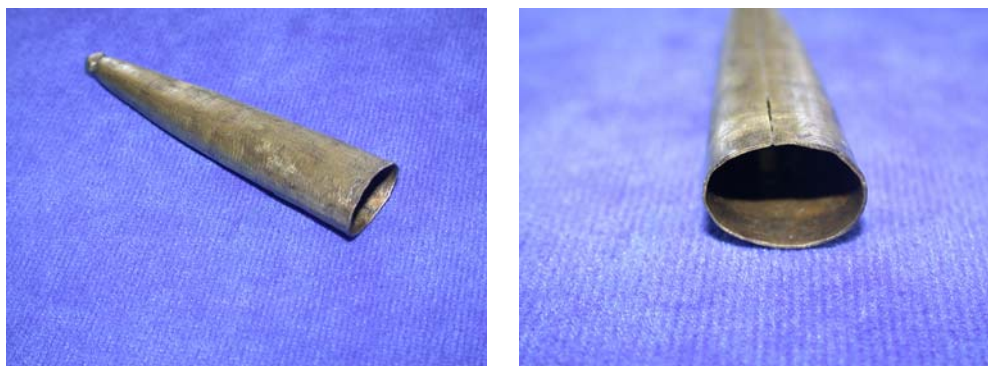


Figure 22. Brass chape 11500-3 from the *Belle* chest. Photography by J. Swanson.

Among the memoirs given by La Salle to the Marquis de Seignelay in 1684 was a list of the items needed to fill out an expedition to Louisiana. Among the items he requested were one hundred and fifty swords plus an equal number of sabers (Cox 1905:187). In their depositions to the Spanish on May 1, 1689, expedition members Jean L'Archeveque and Jacques Grollet both stated that the majority of men wore either cutlasses or swords (O'Donnell 1936:17, 19). The Talon brothers concurred in their interrogation by saying that each time La Salle explored the surrounding countryside, each of the 25 or 30 men would carry, along with other weapons, sabers or straight swords (Bell 1987:227). A large number of swords were discovered aboard *la Belle* and will be discussed in a forthcoming Texas A&M University Anthropology dissertation by Jeffrey Kampfl. One hilt specimen (Artifact No. 13282), very similar to that from the chest artifact, consists of the brass knuckle bow, guard, and pommel. Similar sword pieces were drawn by Diderot (1966:*Fourbisseur*, Plate IV, Figures 44, 47, 50–51, 56). His chape, more square than oval, exhibits the same type of finial. Diderot also illustrates a grip, probably completely manufactured out of metal, which has simpler ornamental braiding but is still reminiscent of the *Belle* chest's wood and silver grip. Additional drawings by Diderot show a more ornate version of a knuckle bow and guard, along with a hilt set up that is the same as that from the chest.



Figure 23. Brass knuckle bow 11500-25 from the *Belle* chest. *Photography by J. Swanson.*



Figure 24. Brass guard 11500-36 from the *Belle* chest. Left: Side facing blade. Right: Side facing grip. *Photography by J. Swanson.*



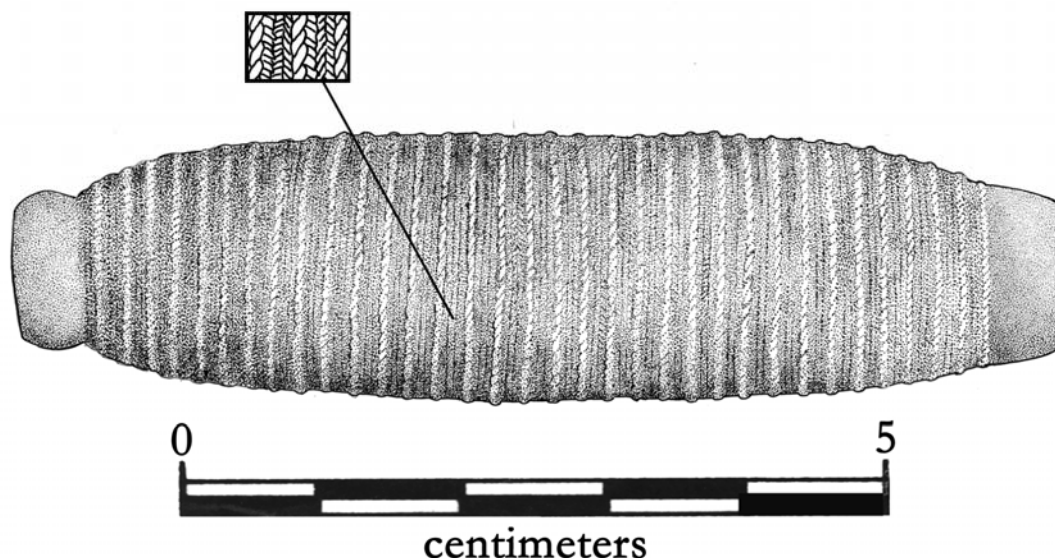


Figure 25. Reconstruction of grip 11500-37 from the *Belle* chest. Drawing by A. Borgens.

According to research based on the sword remains from the *Machault*,

the *à la mousquetaire* sword was standard issue for various branches of the French military from the late 17th through the mid-18th century, although by that time the sword was not the soldier's primary fighting weapon. Both the knuckle guard and pommel are made of cast brass, and the grip is a wooden core wrapped with twisted brass wire. The missing blade would have been made of steel. Not as durable as the arsenal saber, the few *à la mousquetaire* swords found on the ship had probably been discarded by the troops being transported to Canada (Sullivan 1986:43).

Men did not always carry swords solely for protection, however. Out of this purpose grew its use as an item of fashionable attire, and its physical use tended less toward war and more toward sport or personal altercation, especially near the end of the 17th century. Port Royal probate inventories include a number of sword references, including that of a large backsword with a silver hilt and a silver hilted rapier with a half shell (Thornton 1992:168). John Philpott, who lived as a blacksmith at Port Royal, had many sword related items in his inventory, including children's swords as well as silver wire that supposedly could have been used on sword grips similar to this one from the chest (Appendix E).

Many sword hilts and hilt fragments have been recovered from archaeological sites. The excavation at Port Royal in 1965 uncovered one complete brass knuckle bow and fragments of two others (Marx 1967:275). The wreck site of the Spanish *Girona* had several sword grips, and the 1653 *Vergulde Draeck* requisition list mentioned 500 fine broadswords and 500 fine swords (Sténuit 1972:Figure 21;

Green 1977:388–392). A brass hilt from a rapier or small sword (knuckle bow, guard, and pommel) was discovered on the Mombasa wreck. This hilt is similar in form to that of the *Belle* artifact (Piercy 1977:342, Figure 12.A). The HMS *Hazardous*, sunk in 1706, contained a small sword or rapier hilt also similar in design to the *Belle* example with the grip, knuckle bow, and guard all present (Owen 1988:289, Figure 3). An ornate silver sword hilt from the 1711 wreck of *de Liefde* is very similar in basic form to the *Belle* hilt. This artifact has a knuckle bow measuring 12 cm long and a guard measuring 8 cm across (Bax and Martin 1974:87, Figure 9). The *Whydah* wreck site had several sword hilt fragments, as well. Half of a guard has decoration very similar to the *Belle* example, though the artifact's overall shape is somewhat different. Another complete guard and partial knuckle bow from the *Whydah* have comparable shapes, including the unusual uneven small circular designs around the juncture. A plain wooden grip was also recovered from that site (Hamilton and Binder 1992). The 1733 *Flota* wrecks contained several brass and silver sword hilt specimens as well, including some similar to that from the *Belle* chest. The brass hilt had lost the arm of the knuckle bow, but the remainder was complete enough for measuring. The silver hilt was also missing the arm of the knuckle bow, but retains the guard and grip. This grip is exceedingly like that found in this chest (Skowronek 1984:103–108, Figures 50–54). Two sword hilts and two sword blades with wooden sheaths were also found upon the Jutholmen wreck (Cederlund and Ingelman-Sundberg 1973:320).

Scabbard tips appear more rarely in the archaeological record than do sword hilts. At least three scabbard tips were discovered in the 1965 excavation of Port Royal. Manufactured of brass, these all have very flat oval bases as opposed to the rounded oval on the *Belle* chest's example (Marx 1967:273). The *Flota* shipwrecks contained at least one sword scabbard tip, but at 28 cm long, it is much larger than the *Belle* chape. Much closer in length is a bayonet scabbard tip measuring 5.0 cm long, 0.5 cm wide at the tip, and 1.4 cm wide at the opening (Skowronek 1984:112, Figure 58).

#### *Drumsticks (11500-11, -38, -39, -40)*

Four drumsticks were discovered within the chest (Figure 26). All are large, solidly made, and have several grooves of lathe-turned decoration. Two drumsticks (Artifact Nos. 11500-11 and -38) form a matched pair, suggesting they may have been a set (Figure 27). These have rounded tips and butts. The two other drumsticks have flat butts and tips that are more pointed. One of these (Artifact No. 11500-40) is otherwise very similar to the first two mentioned. The fourth drumstick (Artifact No. 11500-39) is much longer than the other three and had a flat butt instead of a rounded, finished end.

The use of drumsticks occurs in an account of La Salle's expedition. On 20 February 1685, the day *l'Aimable* sank, two of seven or eight men who had been sent to chop down a tree returned to the base camp after a party of Karankawan Indians tried to capture them. They immediately armed themselves and set off to locate the Indians and their captured companions. The Indians were openly confrontational.

However “when they saw that we were advancing toward them fully armed, to the drumbeat, they turned around as if to flee, believing we were going to attack them” (Joutel 1998:88). The Talon brothers concurred with Joutel’s statement, though in broader terms.

These idiots feared not only the noise of the firearms, but even that of the drums; for example, the Clamcoëhs, having mobilized for the purpose of destroying the French, because M. de la Salle had arbitrarily taken their canoes, as has been said, were so terrified at the sound of the drum, which [the Spaniards] beat to prepare themselves for defense, that they all fled. Since then they have become somewhat accustomed to these noises of war; and, instead of fleeing immediately in terror, they were content thereafter with throwing themselves on the ground as soon as they heard the shot of cannon or musket, believing thus to put themselves out of reach (Bell 1987:242).

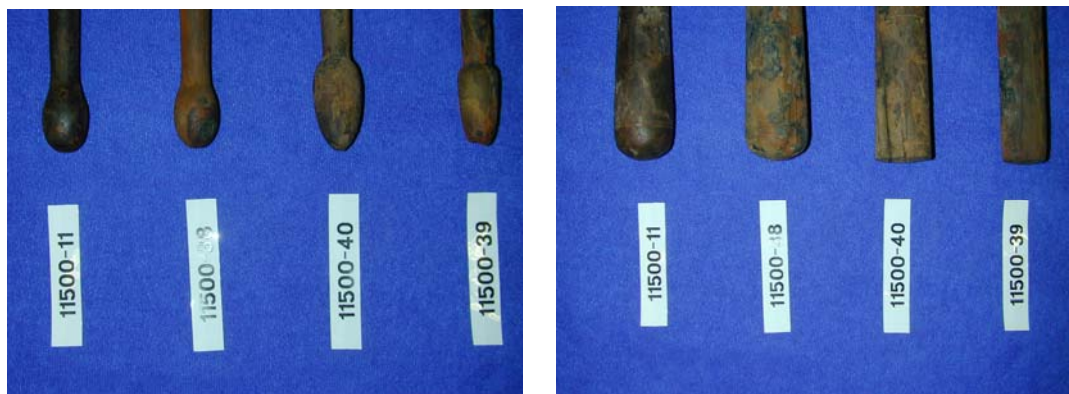


Figure 26. Details of drumsticks. Left: Tip ends. Right: Butt ends. *Photography by M. West.*

Drums would have been used not only by soldiers but also by naval officers for communication purposes (Ross 1981:39). Two drumsticks, one with lathe turnings and possibly of ebony, were recovered from the 1656 *Vergulde Draeck* wreck. Requisition lists for the East Indies from the ship included many other drum related items (40 drums, 300 drum skins, 200 snares, 200 strings, 200 brace strings, and 50 drum-carrying bands), though not drumsticks specifically, so it is unclear whether these were meant for the Indies or were for use aboard ship. It is known that the Dutch *Constapel* would have had at least one drum available for shipboard use (Green 1977:234). Skenbäck (1983:68–70) additionally illustrates a drumstick-wielding man from the 17th century.



Figure 27. Drumstick 11500-11. *Photography by J. Swanson.*

#### *Musket Ball (11500-26)*

A single small lead musket ball was recovered from the chest. Musket balls are often one of the most ubiquitous sets of remains found aboard many shipwrecks from this period, especially those of a military nature. In sheer number, lead shot was the second most common item recovered from the *Belle*. It was only eclipsed in number by the volume of glass beads collected from the wreck. In 1684, La Salle submitted a list to the Marquis de Seignelay. This list compiled all the items La Salle believed necessary for his expedition. Among the items he requested were “musquet balls of the proper caliber in proportion” (Cox 1905: 187–188). A large quantity of shot had to be offloaded from the vessels and taken to the fort.

The canoes, however, brought a hundred barrels of powder and three thousand pounds of lead bullets, which could be bagged and fired from the cannon with devastating effect upon an attacking force.... Musket balls would adhere to a more-or-less uniform caliber, but the lead balls found in great quantities in the *Belle*'s wreckage were of many different sizes, suggesting that they were intended for the purpose described here (Weddle 2001:186, 294, Note 20).

As around 3000 pounds of both bird and musket shot were found aboard *la Belle*, the presence of a single musket ball in the chest is both unremarkable and, yet, simultaneously noteworthy to be found alone. The piece is average and indistinguishable from the other shot on board.

A plethora of shipwreck sites have yielded shot remains, only a few of which are in the following examples. Small lead shot were found aboard the Molasses Reef wreck, and two lone lead musket balls were found on the 16th-century Cattewater wreck, measuring 1.3 cm and 1.6 cm (Keith et al. 1984:56, Figure 11; Redknap 1984:48). Approximately 34 examples of shot were discovered aboard the 1583 *Ann Francis* wreck, with measurements ranging from 1.3 to 1.8 cm and 19.6 to 36.8 grams (Redknap and Besly 1997:201, Figure 12). Lead shot with a diameter of 1.9 cm was found at the wreck site of the *Santa Maria de la Rosa*, a 1588 Spanish Armada wreck (Martin 1975:Plates 6a–b). The Stonewall wreck from the 17th century held lead musket balls in two sizes: five balls 1.9 cm in diameter and weighing approximately 38 grams each, and nine balls 1.6 cm in diameter and approximately 21.9 grams in weight (Dethlefsen et al. 1977:325). The *Lastdrager* sank with thousands of lead shot aboard, measuring from 1.2–1.7 cm in

diameter with weights of 15 to 29 grams (Sténuit 1974:225). Approximately 3000 lead shot for muskets were recovered from the *Kennemerland* wreck, each approximately 1.7 cm in diameter (Price and Muckelroy 1974:263). From the wreck of *el Gran Griffon* were discovered 427 musket balls (approximately 2.0 cm in diameter), 1673 harquebus balls (1.3 cm diameter) and 3 pieces of lead scatter shot (0.3 cm diameter) (Martin 1972:65, Figure 5). The earthquake at Port Royal in 1692 caused the destruction of many vessels in port. From one shipwreck, 295 lead shot of various calibers were discovered, the diameters of which ranged from 0.89 to 2.03 cm (Clifford 1993:260–261, Figure 76). A large quantity of shot was recovered from the 1729 wreck site of the *Curaçao*. A sample of approximately 200 was raised for analysis, measuring between 1.1 and 1.8 cm in diameter (Sténuit 1977:112–113). The continental gondola *Philadelphia* had shot that measured approximately 1.6 cm in diameter and larger (Bratten 1997:193, 299, Figure A.31). Three lead musket or pistol balls were found at the *Eagle* site, each with a diameter of approximately 1.6 cm (Crisman 1987:240, 249, Sh. 4). From the barque *Eglinton*, which wrecked in 1852, were recovered 817 lead balls, each 1.7 cm in diameter and weighing an average of 26.6 g with a total set weight of 27.3 kg (Stanbury 2003:132).

#### *Thimble (11500-7)*

A small piece of dimpled brass from the chest may be a thimble fragment. Seymour (1984:348), in his book *The Forgotten Arts and Crafts*, illustrates Victorian thimbles with dimpling similar to the fragment from the *Belle* chest. Thimbles are commonly found in nautical sites. For example, a single thimble was also recovered from the Jutholmen wreck, and another complete brass thimble was recovered from the wreck site of a mid-16th-century Portuguese vessel (Cederlund and Ingelman-Sundberg 1973:320; Blake and Green 1986:18, Figure 17). Thimbles were sometimes made of materials other than brass, however. Four thimbles were recovered from a 17th-century merchant wreck site in the Dominican Republic. Three were copper alloy, but a fourth thimble was gold washed, and a fifth artifact may have been an iron thimble (Throckmorton 1986; Hall 1996:194).

Thimbles could be decorative or plain and vary in size. There were principally two types of thimble design, those with rounded closed tops and those that were open. Both varieties were found among the 18 brass thimbles from the wreckage of the *Kennemerland*. The 11 thimbles with open tops are believed to have been used by male sailors, while the seven closed thimbles are called a “ladies’ type” by the authors (Price and Muckelroy 1974:264; 1977:204, Figure 16). Several thimbles were recovered from the wreck of *le Machault*. The largest one had an open top and was identified as a tailor’s thimble (Sullivan 1986:92). Diderot (1966:*Tailleur d’Habits*, Figures 10–11) also illustrates thimbles used by tailors, including both closed and open types. Additionally, several brass thimbles of varying design were discovered during the 1965 excavation of Port Royal (Marx 1967:303).

Researchers studying thimbles from archaeological sites have suggested that thimble size may be correlated with the gender of the user. For example, a small thimble from a Dutch boat wreck (D 15, sunk sometime after 1742) indicates it may have belonged to a female (Van Holk 1997:224–225, Figure 9). A large number of thimbles discovered on the Mullion wreck are of two distinct sizes. The authors also suggest this size disparity may be indicative of thimbles for both men and women (Larn et al. 1974:75, 77, Figure 13). The *Sacramento* carried many thimbles in varying sizes that were probably part of its cargo, although the author does not speculate as to their possible gender correlation (Pernambucano de Mello 1979:220, Figure 20).

#### *Hair (11500-13)*

A small tuft of hair was recovered from one end of the chest. The hairs all appeared to be quite short and brittle, were unbound, and could not be associated with other artifacts in its vicinity.

Hair is primarily composed of keratin, a type of durable protein. As new cells are produced in the skin, the old ones are pushed outward. As the cells exit the follicle, they die. On mammals there are three major types of hair: fur hair, guard hair, and vibrissae. Vibrissae are whiskers that, because of constant abrasion, are generally of little use in species identification (Trevor-Deutsch 1970:4, 7). The hair is composed of three concentric layers (medulla, cortex, and cuticle) that are unique to each mammal and can be important in identification studies. The outer cuticle of human hair is composed of imbricate scales with narrow margins, and the central medulla is amorphous in appearance. The cortical layer, between the inner medulla and outer cuticle, has a number of features distinctive to humans, including elongated spindle-shaped cells, cortical fusi, pigment granules, and sparsely distributed ovoid structures (Hicks n.d.:3–4). Moreover, the medulla is fragmented or absent in Caucasian hair. Bear and cattle hair share similar features to Caucasian hair, and thus were also closely examined in this study (Moore et al. 1974:24).

To determine the species origin of the *Belle* hairs, they were taken to Dr. Vaughn Bryant, Professor of Anthropology at Texas A&M University. Dr. Bryant and the author examined the degraded hairs for a number of diagnostic features (Figure 28). Both Bryant and the author agreed that the hairs found in the chest were most likely human hairs, though their composition and brittleness during sample preparation precluded an unequivocal identification.

Discussion with Dr. Kevin Crisman, Professor of Nautical Archaeology at Texas A&M University, suggested the possibility that the lock of hair was a love token, maybe from a sweetheart back in France. It may also have been from a deceased individual, and the owner of the chest was keeping it safe to return the token to relatives remaining in France (personal conversation, June 2004). Unfortunately, no twine or other tie was observed around the relatively short bits of hair, so whether this was specifically a lock of hair meant for some later purpose is unknowable.

The presence of hair on a vessel often indicates one of two possible uses, as demonstrated by the finds from *le Machault*. The first is in a blacking brush, a wood-handled, hair-bristle brush with a woven cord tie; the diameter of the tied bristles on the recovered example was 3.4 cm. Similar brushes could also have been used for glue or paint. Secondly, from examination of the hull remains, a caulking material consisting of a mixture of animal hair and hemp was used for plank seams below the waterline (Ross 1981:209, 213). As the quantity of hair from the chest is so small, neither of these possibilities seems likely, and even less so if the hairs were indeed from a human head.

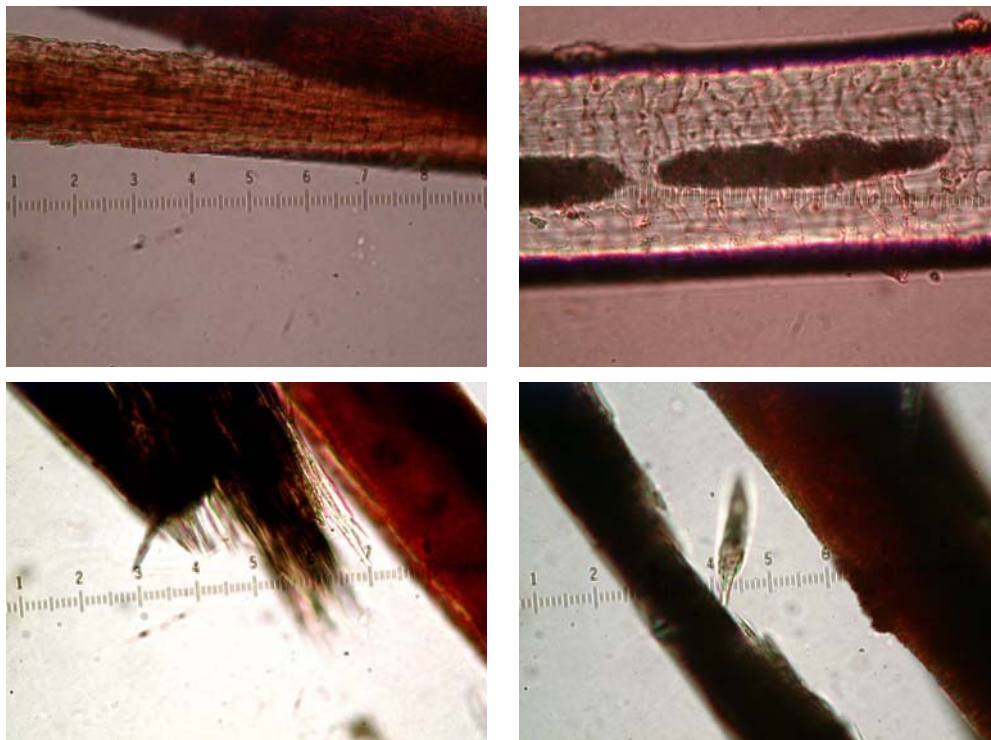


Figure 28. Hair from the *Belle* chest. Viewed under a microscope with a variety of magnifications. The two lowest photos demonstrate the brittleness of the hair with the ends splitting and pieces flaking away. Photography by V. Bryant and M. West.

#### *Reaping Hooks (11500-21, -22)*

Two reaping hooks from the chest were found, each consisting of a non-serrated iron blade with cylindrical wooden handles (Figure 29). The handles were decorated with lathe-turned grooves (Figure 30). The iron tangs extended through the center of the handles and were clenched over the far end.

The reaping hook is an ancient tool that has taken on many forms over the millennia, having been made of such diverse materials as flint and bone, copper alloys, and iron (Petrie 1916:LIV, Figures 1–37).

They could be used for harvesting many things, such as their use as shearing hooks for harvesting thatch for roofing (Seymour 1984:54, 82). Sloane (1964:100–101) differentiates sharply between sickles and reaping hooks, however. The slender, sharp blade of the reaping hook was used for cutting, as opposed to the serrated edge of a true sickle, present even in early specimens, which was more suited to slashing. Elements of the two *Belle* examples are present in both the reaping hooks and sickles that Sloane illustrates, but without the characteristic blade serrations, the two artifacts here are most likely small reaping hooks. A reaping hook of similar form to those from the chest is pictured in Diderot (1966:*Agriculture*, Figure 3) as a tool used to cut or saw wheat.



Figure 29. Reaping hook 11500-21. (Preconservation). *Photography by A. Borgens.*

#### *Cattle Hook (11500-32)*

Another object from the chest consisted of a large wooden cone inserted into a thin iron sleeve. The sleeve was attached to the wood with several large iron nails. The sleeve tapered near the point of the wooden cone and then flared and branched out into an iron hook and a slightly bent straight tine (Figure 31).





Figure 30. Comparison of the wooden handles from the two reaping hooks. *Photography by J. Swanson.*



Figure 31. Preconservation cattle hook 11500-32 from the *Belle* chest. *Photography by J. Swanson.*

There are several possibilities for identifying the original purpose of this object, as the form of a hook with an extending finger is used for a number of different tools. For example, fire hooks as described and photographed by Petrie (1916:57, LXXI, Figures 50–51) have the same straight points and curved hooks, although the objects appear otherwise much less heavy. At the handle end of the objects are holes from which chains attach the hooks to braziers, so there are no sockets for the insertion of wooden handles. As opposed to the fire hook, another similarly shaped item is described in an antique catalog as an ice pusher/log roller, though there is again no socket for a wood insertion piece (McNerney 1979:137).

A stronger possibility for its use is that of a gaff. A gaff is similar to a boathook, except that the gaff has an additional straight arm emanating from the base of the hook. The wooden handle, which is believed to be sawed off this *Belle* artifact, would have been much longer and, therefore, could have been used in the handling of small boats. Although there are a number of reasons to support this case, based upon a contemporary French illustration, it would seem that the hook is in fact a *croc à boeufs*, as shown by Diderot (1978:331, Figure 16). This object, literally a cattle crook, is shown in relation to the occupation of a butcher. Unfortunately, Diderot neglects to show it in use or to mention it in the text, so its exact function is left in doubt. It may have been used for directing cattle into place, either by hooking the horns and pulling for guidance or else by prodding the animal with the tip. The dimensions precisely parallel the one from the chest, however. If this is indeed its true identification, the entire object, including the original handle, should have been approximately 3 French feet, 8 inches long (1.04 m).

#### *Seven-Tine Fishing Spear (11500-27)*

The large seven-tine fishing spear from the chest had no wooden handle attached. It consisted of a single socket that flared out in a single plane into the seven evenly spaced, parallel tines of the spear. Each arm ended with a hook that was bent toward the center tine. The center tine ended with a double-barb. Knotted rope was woven around each of the tines and the flared end of the socket. The woven rope loosely continued along the side of the spear's socket.

Although the use of a multi-pronged metal fishing spear is not mentioned by any of the firsthand accounts from the La Salle expedition, fishing as a means of sustenance is. Joutel (1998:100) states: "On occasion, our people went around several small salt lakes near our fort and found near shore certain flatfish like turbot sleeping, and they speared them with big pointed sticks." A regular iron fishing spear would have a socketed head attached for the insertion of a long wooden shaft. A long length of rope would be attached to the spear to allow play and pull for both the harpoon and the catch. This device was generally used to catch small whales, large fish, dolphins, and eels instead of using nets or hook-and-lines (Ross 1981:287; Sullivan 1986:52). A drawing in Diderot (1966:*Pesches de Mer*, Plate XVI, Figure 3) illustrates night fishing from a small boat in a bay. Each of the men is shown holding long-handled five- and six-tine spears.

Multi-pronged fishing spears are not commonly found in shipwreck sites. One of the earliest examples is that of a three-pronged barbed bronze trident from the 14th-century B.C.E. Uluburun wreck. This was discovered with wood remaining inside the shaft (Pulak 1998:211, Figure 23). Illustrations of several other types of multi-pronged fishing spears are found in Petrie (1916:57, LXXII, Figures 54–57). Three of these are from Egypt and Switzerland and have three prongs. Another spear, from Germany, has seven prongs, each with a small hook on the end except for the arrow-shaped one in the center. A complete seven-tined fish spear (also known as a fish gig) was recovered from *le Machault*. The four-piece iron spearhead consisted of a socketed tang with a double barb at the opposite end. Through the shaft passed three U-shaped rods, the single barbs of which all pointed away from the center's double barb. The width across its prongs was 26.0 cm, and its incomplete length (a part of the socket was missing) was 34.0 cm. An additional five-prong spear had the tines separated by wooden wedges and was held together by fibers woven about the prongs. On this specimen, the single-barbed tines point toward the center's double barb, and the prongs were all forged into a single tang. Its incomplete length was 26.0 cm (Ross 1981:289–191, Figures 115–116).

#### *Fishing Sinker (11500-20)*

A number of lead objects discovered aboard the *Belle* have been identified as various forms of fishing sinkers. The chest contained one of these sinkers, consisting of a small sheet of lead rolled into a lowercase letter *e* shape (Figure 32). A classification typology created for the analysis of lead sinkers from the Israeli coast is useful for this discussion. It identifies sinkers, such as the one found in the chest, as Bent Plate for a Tube. The Bent Plate for a Tube is essentially a pre-cast sheet of lead, bent into its final tube shape by the fisherman or net maker. The seven specimens falling into this category in the Israeli study are further divided into three subcategories with the following measurements: large short tubes (36.6 mm average hole diameter, 79 g average weight, 3 mm average plate thickness, 15.5 mm average height), small short tubes (17.5 mm hole diameter, 9.5 g weight, 2.2 mm plate thickness, 2.5 mm height), and long tubes (8.7–17 mm hole diameters, 38 g average weight, 3.2 mm average plate thickness, 25.5 average height) (Galili et al. 2002:183–187, Figure 2b, Table 1).

#### *Dividers (11500-34)*

A pair of brass dividers, with tips missing, was found in the chest (Figure 33). The ball joint connects two straight legs that end with grooves for the insertion of iron tips. The dividers from the *Belle* chest are known as friction style dividers, or sometimes as the true compass (Pernambucano de Mello 1979:218; Kean 1998:99). Generally, brass dividers were used for navigation and drafting, while iron ones were used by carpenters for taking and transferring measurements (Moxon 1677:104; Franklin 1992:96). Hamilton (1992:217) states that compass legs allow one to insert:

iron nibs or a marking tip or stylus. Dividers are defined by possessing points on both legs. Essentially the same instrument as a draftsman's compass ... the charting compass is differentiated from the divider in that the charting compass was used to delineate and mark circles and arcs, while the divider was used to measure off scales, measure distances, or divide into equal parts. However, the two could be used interchangeably for many tasks and so are often called both dividers or compass in the literature without respect to specific function.

A number of brass and iron compasses of varying historical periods are illustrated in Petrie (1916:LXXII, Figures 212–221). Additionally, a large number of compasses/dividers that are very similar in form to the one from the *Belle* chest are illustrated by Diderot (1966:*Architecture Maçonnerie*, Plate XI, Figure 74; *Charpente*, Figure 22; *Ébéniste*, Figure 85; *Fleuriste artificiel*, Figure 6). Kilby (1971:58, 80, Figure 34) also discusses using dividers/compasses (terms he uses interchangeably) in order to mark and determine the size of cask heads. A type of compass used by French wine coopers is illustrated as well. In comparing the *Belle* dividers to the various illustrated types, they are likely a pair used for ship navigation.



Figure 32. Fishing sinker 11500-20 from the *Belle* chest. At left is another example from the shipwreck. Photography by J. Swanson.



Figure 33. Brass navigational dividers from the *Belle* chest. Photography by J. Swanson.

A large number of dividers similar to those from the *Belle* wreck have been found at a variety of sites. The wreck site of the pirate ship *Speaker* lost off Mauritius in 1702 held five pairs of dividers, mostly of the type that could be opened and closed with one hand, though at least one specimen is of the same type as that from the *Belle* chest (Lizé 1984:125, Figure 4). Also, similar to the pair from the *Belle* chest were dividers from a kit of navigational tools discovered at the wreck site of the *Defence*, an 18th-century privateer (Smith 1986:169–171, Figure 84). Another similar, though heavily eroded, pair also missing the iron points were found at the *Kennemerland* wreck site (Dobbs and Price 1991:120, Figure 13). The 1707 Scilly Island wrecks produced at least three pairs of dividers, although a pair from the much later 1798 *Colossus* wreck are a closer comparison to the *Belle* chest's set (Morris 1984:257). Dividers from the mid-18th-century *Boscowan* warship wreck were manufactured with a ball-like hinge in eight sections. Its semi-circular arms were without iron tips. These dividers are 6.3 cm in length with a diameter of 0.9 cm, making it very similar to the *Belle* set's measurements (Erwin 1994:141, 229, Figure C-67:b). Five brass compasses were discovered on the 1668 galleon wreck of the *Sacramento*, four of which could be used with one hand. The fifth is nearly identical to the *Belle* chest dividers (Pernambucano de Mello 1979:218–219, Figure 10). Eighty pairs of brass navigational dividers were discovered aboard the *Lastdrager*, 72 of which were part of the ship's cargo and still contained the tallow used for hinge lubrication. Although the other eight pair probably used by the ship's crew are of varied types, it is the cargo dividers that appear identical to the pair from the *Belle* chest, although the *Belle*'s did not sport the fleur-de-lys mark these have (Sténuit 1974:232–235, Figures 14–16). The 1965 investigation of Port Royal recovered at least five pairs of dividers, one (length 9.21 cm and head width 0.95 cm) very similar to that from the *Belle* chest (Marx 1967:265). Other brass dividers from *la Belle* are both of the single-hand kind and the friction type (Artifact Nos. 784, 1588, 1640, 2370, 3099, 4953, 5817, 11232, 11746, and 13207). Additionally, other forms of dividers dissimilar to Artifact 11500-34 have been recovered from many other sites: *Santa Maria de la Rosa*, *Kronan*, *Vergulde Draeck*, *Dartmouth*, *Ann*

*Francis, Whydah, Hazardous, Machault, Kennemerland, Flota, Curaçao*, the Pepper Wreck, and later work at Port Royal (Price and Muckelroy 1974:264, Figure 6; Martin 1975:Plate 14; Green 1977:195; Sténuît 1977:111–112, Figure 6; Muckelroy 1978:124, Figure 3.33; Ross 1981:81–82, Figure 13; Skowronek 1984:161, Figure 98; Owen 1988:289; Einarsson 1990:293–294, Figures 15, 17; Muncher 1991:339; Hamilton 1992:219–220; Redknap and Besly 1997:198–200, Figures 9–10; Brigadier 2002:36–37, Figures 7–8; Custer 2004:158–161, Figures 99–101). The prevalence of navigational dividers recovered from wreck sites demonstrate how important they were to mariners.

#### *Sounding Lead (11500-6)*

The octagonal sounding lead still retained part of its length of rope. One end tapered toward the eye for the rope and at its opposite end was a depression with many deep, haphazard grooves (Figure 34). These grooves would have better enabled the wax to adhere to the lead to obtain bottom samples as the weight hit the sea floor. Two different types of sounding leads were used for determining the depth and composition of the ocean floor. A smaller coastal type similar to the *Belle* chest's example usually consisted of a hand lead weighing 2.7–4.5 kg with lines 20 fathoms in length (Ross 1981:75). A deep-sea sounding lead would be weighted approximately 6.4 kg and have lines around 200 fathoms in length. This could be used to approximate one's nearness to land before it could be sighted. Once the sounding lead hit the ocean floor, the ship was determined to be "within soundings" (Weddle 1973:54; 2001:264, Note 13; Ross 1981:75).



Figure 34. Sounding lead. Left: Indentation and grooves in bottom for wax. Right: Complete lead. Photography by J. Swanson.

Additionally, the Enríquez-Barroto diary highlights the role and importance of the pilot and his use of sounding leads in coastal exploration in the late 17th century.

The diary presents a rare close-up view of coastal navigation in the seventeenth century. The concern with the weather—even to the point of noting the slightest wind change—though of only passing interest to the present-day reader, was of vital importance to the mission; likewise the water depth and nature of the bottom, the record of which, with the pilot's description of the shoreline, was designed to guide future voyagers. The character of the bottom had a dual significance. Samples of the material brought up by the wax-filled lower end of the sounding lead indicated whether or not it was suitable for holding an anchor. The nature and color of the substance clinging to the wax also provided a record by which mariners of the future could determine their position, for the deposits in a given locality usually had some distinguishing quality. An experienced pilot could read these samples with amazing accuracy (Weddle 1987:134).

Compared with other items from the chest, mention of sounding weights is the most prevalent from the La Salle expedition's surviving primary accounts. Finding the depth of ill-known shores was paramount to an expedition's success, as it was quite easy to ground and lose one's all-important lifeline, the ship. The requisitions list for the 1653 *Vergulde Draeck* held, among other items, 200 sounding leads. This underscores the importance of the tool and the ease with which it could be lost (Green 1977:384–388, Table 6-20). From the time La Salle's vessels reached the continent, soundings were continually made, especially by the crew of *la Belle*, as that ship had the shallowest draft (Weddle 2001:149). Depth misperception may also have been an important factor in the blame for the loss of *l'Aimable* as it attempted to enter Matagorda Bay (Joutel 1998:87). The following La Salle expedition primary account examples mention the use of this instrument:

When we were abeam of the cove, the order was given to the *Belle* to go and sound to find out if there was good anchorage. She found out at the point of the \_\_\_\_\_ that there was about 15 or 16 fathoms of water and good bottom of coarse white sand (Joutel 1998:63).

Orders were given to the *Belle* to go ahead and take a sounding and to signal in case she found land. ... When we joined her, we learned that she had taken a sounding of 30 fathoms of water with a muddy bottom (Joutel 1998:64).

At 9 o'clock, we found 10 to 11 fathoms and fine, grayish, and muddy sand ... From noon on, we continued our course sounding all the while (Joutel 1998:65).

As we sailed closer to the land than the *Joly*, sounding all the while, we found ourselves in four fathoms of water, then five, and six fathoms (Joutel 1998:66).

We set the same course, running always with the sounding line in hand (Joutel 1998:69).

Not seeing anything he had sounded and measured just one fathom of water (Joutel 1998:70).

From the entrance we went to the *Aimable*, but M. de La Salle did not want to come and sound with us. We went to sound. The sounding lead, which is a foot long, found 25 feet, 15 feet, 8 feet...(Minet 1987:105).

We steered south to stand off, and then sailed to the southwest, sounding all the while until about 8 o'clock the next morning (Joutel 1998:74).

With the sounding line in hand all the while, we sailed until 7 o'clock in the evening when we set anchor in six fathoms of water (Joutel 1998:75).

The pilots and the king's scribe who made the official report of the soundings with M. de La Salle have returned, and he made them wait for high tide, according to what they said; but it is very irregular. They found one more foot than we did, but it is because they counted the lead [That is, they included in the measurement the length of the sounding lead, which was presumably about one French foot.] (Minet 1987:108, Note 48)

La Salle spent all that winter [1685–1686] sounding and inspecting the whole of the surrounding bay, trying to bring the eight-piece frigate closer inside [as stated by Pierre Meunier] (Foster 1998:288).

After [the *Belle* sank], this witness [Jacques Grollet] took soundings there (O'Donnell 1936:19).

Sounding leads are commonly found at shipwreck sites. Examples before 1686 include the Molasses Reef wreck, the *Ann Francis*, the Stonewall wreck, the *Lastdrager*, the *Vergulde Draeck*, the *Kennemerland*, and the *Sacramento*. The early 16th-century Molasses Reef wreck site produced an octagonal sounding lead 23 cm long with a base diameter of 6 cm, though slightly more cone-shaped than the *Belle* artifact (Keith et al. 1984:56, Figure 12). Two sounding leads were recovered from the *Ann Francis* wreck of 1583. The first had a circular cross section with a length of 10.25 cm and a weight of 1.96 kg. The second, though much larger, is quite similar in form to the one found within the *Belle* chest. It also has an octagonal cross section with a recess in the lower end for tallow. Its weight is 6.10 kg, and its length is 17.9 cm (Redknap and Besly 1997:200–201, Figure 11). This is also very similar to a sounding lead from a Spanish Armada vessel wrecked in 1588 (Rodríguez-Salgado 1989:Figure 12.20). The 17th-century Spanish vessel from Stonewall, Bermuda, held one small conical sounding lead 7.5 cm long with a maximum diameter of 3.4 cm. The artifact weighs 4.1 kg. The hole for the rope to pass through is 0.57 cm wide. A depression on one end is present for wax (Dethlefsen et al. 1977:325, Figure 12). A deep sea sounding lead from the *fluit Lastdrager* weighs 6.550 kg and would have been used to measure depths of 40–80 fathoms (Sténuit 1974:231–232, Figure 13). Several sounding leads were also recovered from the 1656 *Vergulde Draeck* wreck. Two of these leads were likely deep-sea leads, while the third may actually have been a fishing sinker. One of the deep-sea leads described weighs 6.3 kg, a little less than the 6.91 kg commonly used on Dutch ships (Green 1977:209–211). Two complete octagonal sounding leads (68 cm long) and one fragment (30 cm length remaining) were found on the *Kennemerland* (Price and Muckelroy 1974:263). Sounding leads in various sizes were also found in the stern area of the 1669 galleon wreck of the *Sacramento* (Pernambucano de Mello 1979:219). *Belle*



excavations also produced one other sounding lead from what may have been the boatswain's cask (Artifact No. 3419).

Wrecks with sounding leads from after 1686 include the Jutholmen, the *Whydah*, and the *Curaçao*. Sounding weights recovered from the Jutholmen wreck include one in the shape of a fish (Cederlund and Ingelman-Sundberg 1973:321, Figure 15). The *Whydah* excavators claimed to have three sounding leads from the ship, though for discussion of the third see the counterweight discussion below. Just like the *Belle* chest weight, one of the leads found on the *Whydah* had an octagonal cross section and was slightly tapered. It measures 30.5 cm long, 5.8 cm maximum width, and 4 cm minimum width and weighs of approximately 5.3 kg. It also has a depression in one end for wax measuring 1.4 cm in diameter and approximately 1 cm deep. The other recovered sounding lead is a much larger deep-sea lead (Hamilton 1992:223–224, Figures 83–84). The *Curaçao* produced two conical sounding leads with very slight tapers, a deep-sea one measuring approximately 60 cm long and weighing 14 kg, as well as a shallow water lead 26 cm long and 2.1 kg in weight (Sténuit 1977:111, Figure 5).

#### *Rope (11500-6.2, -27.2)*

Lengths of rope were attached to two items within the chest—the seven-tine fishing spear and the octagonal sounding lead. Spare rope is vital to the workings of a ship, and extra rope is always carried. Seymour (1984:124) states that hemp is the best material anywhere for making rope, which is why mariners use it for ship's rigging. It is strong, long lasting, and does not easily chafe. Rope was usually made in the following manner:

Ropes are made by twisting hemp yarns together. Hemp has to be retted, or rotted in water, and then shived, that is stripped of all its short fibres. A spinster ... then ties great bunches of the fibre to his waist, catches the ends on a turning hook, and walks backwards, paying out the fibre as he goes. The yarn produced is then hardened by twisting, sized by rubbing with a horsehair rubber, and then laid, or doubled back on itself (Seymour 1984:124).

The *Kennemerland* site produced several types of rope. Sections with a larger circumference (8 cm) had a tar-like odor. Smaller cord, called spunyard, was also present (Price and Muckelroy 1974:263). Several coils of rope were recovered from a storeroom in the forecastle of the *Curacao* wreck. These coils were still bound together with string. The three-stranded rope samples made of hemp have various diameters ranging from 0.6 cm to 4.8 cm (Sténuit 1977:111, Figure 4). The requisitions list for the *Vergulde Draeck* mentions several varying types of rope (Green 1977:384–388, Table 6-20). Great quantities of rope were also recovered from *la Belle*. Hemp rope in the bow area consisted of three sizes. Other coils with two different diameters were recovered. Braided line was also found associated with the swivel gun.

*Counterweight (11500-19)*

As with the beef hook, this large lead ball could have several possible uses; unlike the beef hook, however, there is no relatively clear idea for its original purpose. It is spherical with a flash line and a large sprue through which a hole has been drilled. The item is of the same shape and size and with an identical flash line as the iron verso shot also recovered from *la Belle* (Figure 35). It would, thus, appear likely that this object was cast from a verso shot mold.



Figure 35. Possible counterweight 11500-19 from the *Belle* chest. At left is an iron verso shot from the same shipwreck. *Photography by J. Swanson.*

There are several possible uses for this item. A plumb bob is a weight, most often shaped like an inverted pear, which is suspended with its point downward. It is hung on a cord and can show the user whether the work is vertically upright, i.e. 'plumb' (Salaman 1975:380). Artifact 11500-19 may have been intended as a make-shift plumb bob when it was cast. Because of its unusual shape, it may have been

fashioned at La Salle's colony. An actual plumb bob, whose point would have rendered it more precise, could have been obtained in France before departure.

Another possibility for this item's use comes from the Middle Ages. A medieval steelyard weight found aboard the *Mary Rose* is similar in both form and size to the *Belle* chest object. It is believed to be several centuries older (*circa* 1300) than the shipwreck. This weight had a shell of copper alloy terminating in a loop at the top. The shell was filled with lead and used on an unequal-armed balance for weighing bulk commodities, like wool. This practice was outlawed in 1350. Suppositions as to its use aboard *Mary Rose* include a plumb-line weight, a sounding-line weight, or even simply as ballast (Brownsword and Pitt 1986). Additionally, Ross (1981:286) mentions that "Nets also required the use of leads which were much larger and heavier than line leads. Such leads approached the size of small sounding leads, but without the hollow concavity for arming tallow." The *Belle* weight could easily have been attached to a net as a weight, though Ross seems to be describing weights that are more cylindrical, as opposed to spherical in shape.

An artifact almost identical to Artifact No. 11500-19 was found in the wreckage of the *Whydah*. It measures 6.7 cm in diameter and weighs 1.7 kg. The importance of this comparison lies in the excavator's discovery of six strands of hemp rope fiber remaining in the hole of the sprue, each fiber with a width of 0.2–0.5 cm (Hamilton 1992:224, Figure 85; Hamilton and Binder 1992). The discovery of this artifact casts doubt on the locally produced plumb bob hypothesis discussed earlier. A pirate ship seems unlikely to be carrying such an item. Its discovery also weakens the unequal-armed balance weight hypothesis, as this weight would not have been suspended by string. Hamilton interpreted the *Whydah* artifact to be a sounding lead. Lack of an indentation for tallow in the bottom makes this idea seem unlikely, although it perhaps could have been used in lieu of larger leads, if necessary.

Thus far, however, its use as a counterweight seems to be the most practical idea for its original purpose. Suggested by Tom Oertling (e-mail communication, 24 June 2004), there is chance this could have been used for sounding the pump well, although a weight of that size would not have been necessary for such an endeavor. A presentation plan for the Cole-Bentinck chain pump, developed in the last half of the 18th century, shows a ball weight being used to re-install the pump chain. The repair instructions in the figure read in part "Let fall a line thru the back Popit ... [and] make the line fast to the end of the Chain, the other end of the line having a Ball so that it may be hooked with ease" (Oertling 1996:57, 60, Figure 41). The *Belle* pump, however, was a common suction pump and would not have needed this mechanism. Diderot (1966:*Tourneur*) illustrates one piece of equipment using a similarly shaped object as a counterweight as well.

*Pump Valve (11500-45)*

Another lead object from the chest is also difficult to identify. A hexagonal piece of lead with a large hole in the middle has three arms that arch upward to meet in the center of the large hole. In the juncture of these arms is another small hole. It appears to have been formed using a drop-mold, where one side is molded and the other simply shaped. Around the edges of the shaped side are rough depressions (Figure 36).



Figure 36. Possible small hand pump valve 11500-45 from the *Belle* chest. *Photography by J. Swanson.*

Two similar though larger items were found aboard the Molasses Reef wreck, which dates approximately 150 years earlier. Although originally thought to be part of a wheel assembly, the lead was much too soft for such a purpose. They are, therefore, believed more likely to have been used as a one-way valve for a suction pump (Keith et al. 1984:56–57, Figure 13). Oertling (1996:34–35, Figures 18–19) describes the Molasses Reef wreck artifacts.

Each is a disk about 1 cm thick with a raised reinforcing collar around a central hole that is surrounded by seven smaller holes. A horizontal hole through the collar allowed it to be secured to the rod, axle, spear, or whatever passed through it. Such disks would have been quite satisfactory piston valve components and could represent an early form of upper valve. The valve claque would have been a circular piece of leather with a central opening for the spear; tabs left when the opening was cut could have provided a means for lashing the leather in place. The small holes in the disk would have allowed water to pass up through the valve on the downstroke, and the leather would have closed them on the spear's upstroke.

Artifact 11500-45 is much smaller than these; too small for a ship's pump, but potentially the right size for a small hand pump. Additionally, however, there is not a horizontal hole through the collar to secure the rod. Firm identification, therefore, remains problematic.

### *Spool (11500-41)*

This object's true purpose is currently unknown because of its terrible state of preservation. Its form is similar to that of a spool approximately 11.5 cm in diameter and 4.5 cm wide. Four arms radiate at 90 degree angles from a small center hole about 2 cm in diameter. The center hole appears to have a regular pattern of bumps in relief. The outer edge of the spool, however, is solid, with no depth for winding twine or rope around it. Several other small inconsistencies appear in the x-ray as well, including an oblong oval. It is hoped that further work will illuminate its purpose.

### *Textile (11500-18)*

Textile, possibly canvas or sailcloth, was used to wrap the two similar drawing knives (Artifact Nos. 11500-15 and -16). It encircled the blades at least twice and was secured with twine.

Textiles are infrequently found in archaeological sites. Its preservation is often dependent upon how deeply it is buried or if it is encased within or between other items, as in encrustation or between planks of wood. Sail cloth is the predominant textile recovered from shipwreck sites. Its inherent durability, because it had to be strong enough to withstand high winds, aids its preservation. The oldest known Scandinavian sail fragment comes from a terrestrial site, however. In a Norwegian medieval church, sail cloth was used as packing material between planking. These fragments date to between 1280 and 1420 (Cooke et al. 2002:204). The *Wasa* warship held six large sails in storage. These were of two main types: a close-textured one probably of linen and a coarser kind most likely of hemp (Bengtsson 1975:33). The *Whydah* artifact recovery included a large number of fragmentary textiles of hemp, wool, silk, and jute, spun in both Z- and S-twists. None were definitively identified as sailcloth, however (Harvey and Binder 1992). The 1692 Port Royal shipwreck had two gudgeon straps with strips of canvas on the inner faces. They were used to hold pitch and hair sealing materials as well as to better seat the iron gudgeon against the wooden stern (Clifford 1993:174–180, Figures 35–36). The 16th-century Cattewater wreck preserved several examples of textile (Redknap 1984:75–83, Figures 44, 46). All the textiles seem to come from garments, not bales of merchandise. They are mostly of a tabby (plain) weave and a 2/2 (four-shed) twill, with some 2/2 diagonal weft-faced samples. Some were dyed while others were untreated. The samples from the Cattewater seem to have been all made of sheep's wool. Clothing textile fragments were recovered from the Jutholmen wreck, as well (Cederlund and Ingelman-Sundberg 1973:320). The requisitions for the *Vergulde Draeck* listed sailcloth of at least five or seven different varieties (including French sailcloth) (Green 1977:384–388, Table 6-20). Seymour (1984:174–180) describes the process of weaving old textiles in his book *The Forgotten Arts and Crafts*.

## Woodworking Paraphernalia

### *Hatchet, Hewing (11500-17)*

The chest contained a single iron hatchet with a long octagonal pin on its poll. Its blade had been sharpened on one side only, and the eye of the socket bulges to one side. This left one side of the implement completely flat (Figure 37). This form is usually associated with hewing hatchets, which are primarily used for shaping wood. A long pin is rare on these hatchets, but more common on lathing hatchets. An example of a lathing hatchet illustrated by Sloane (1964:18–19, 21) is identical to the chest's hatchet except that his example is symmetrical and lacks a pin on its poll. The asymmetry of a hewing hatchet, however, confirms Artifact 11500-17 as this type. A similar hatchet is also illustrated by Diderot (1966:*Ceinturier*, Figure 24) as that used by a belt maker.

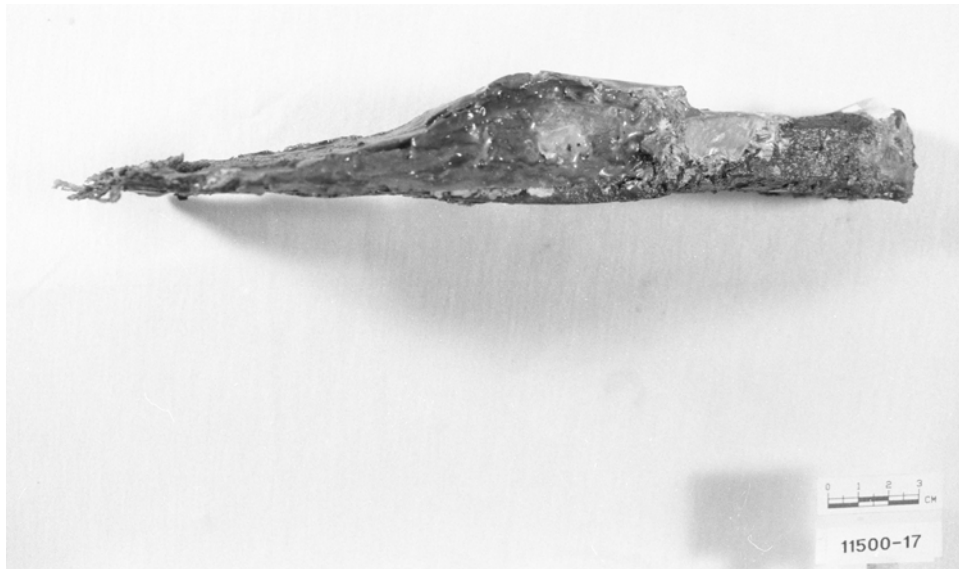


Figure 37. Preconservation profile view of hewing hatchet 11500-17 from the *Belle* chest. Note that one side is flat. *Photography by J. Swanson.*

Hatchets were often traded to the Indians in return for needed supplies. On the day *l'Aimable* sank (20 February 1685), approximately 100–120 Indians approached the camp. Though the attention of the French leaders was on the salvage efforts, Barbier, a Canadian infantry lieutenant, asked to barter with the Indians for some canoes (Joutel 1998:79). Several hatchets were eventually traded for two canoes (Joutel 1998:92). Earlier that same day, six or seven chiefs came to the camp and were given entertainment to secure their friendship. Upon leaving, La Salle presented them with “a few hatchets and

knives,” with which they seemed well satisfied (Joutel 1998:89). The testimony of the Talon brothers, though colored by their years of living among the natives, noted that

M. de la Salle would never have had war with the Clamcoehs if on arriving he had not high-handedly taken their canoes and refused them some little article of use that they asked him in return for them and for other services that they were ready to render him. Nothing is easier than winning their friendship: a hatchet, a knife, a pair of scissors, a pin, a needle, a necklace of a bracelet or glass, wampum, or some other such trinkets being ordinarily the price, because they love passionately all sorts of knickknacks and baubles that are useful or ornamental (Bell 1987:251).

Hatchets are less frequently found shipboard than are axes, but they often have similar shapes. For example, the profile of an axe from the *Philadelphia* is nearly identical to that of the *Belle* hatchet, except for its lack of a pin on its poll. It measured approximately 20.3 cm in length and had a poll approximately 3.5 cm wide (Bratten 1997:194, 302, Figure A.34:c). A hatchet of a different shape, but with the same basic features, was recovered from the 1733 *Flota* wreck site. It had an octagonal pin measuring 2.9 cm thick at the tip. The artifact was 22 cm long, and the estimated original blade width was 12.5 cm (Skowronek 1984:160, Figure 97). An intact straight axe handle was recovered from the *Whydah* wreck. It is 35.6 cm long with a rounded head measuring 3.8 cm by 1.9 cm. The ovular handle tapered to a diameter of 3.1 cm at the opposite end (Hamilton 1992:205). A number of axe heads and a pair of lathing hatchets were also recovered from Port Royal, though none seem to approximate the shape of the hewing hatchet from the chest (Franklin 1992:43–61, Figures 17–40). Although the blade portion of the hatchet is similar in profile to many of the *Belle* axes, the asymmetry of Artifact No. 11500-17, its eye shape, and the presence of the hammering pin on the back side of the socket greatly differentiate it from the ship’s trade axes (Feulner 2002:70, Figure 5). The 18th-century privateer *Defence* wreck site produced a short axe handle that may have belonged to a carpenter’s hewing hatchet (Smith 1986:181). The length of the handle was approximately 53 cm, which makes it very close in size to a loose handle in the chest from *la Belle*. That loose handle may, therefore, belong to the hewing hatchet (Smith 1986:182, Figure 92). Additionally, a large number of tool handles for axes were excavated from the Jutholmen wreck (Cederlund and Ingelman-Sundberg 1973:320).

#### *Axe, Cooper’s (11500-33)*

The cooper’s axe was held close to the head rather than at the end of the handle and was used for shaping. This tool is also sometimes referred to as a cooper’s hatchet or side axe (Sloane 1964:20–21; Seymour 1984:96).

In fact you chop a list, which is an angle and a taper on the edges of the staves, to give them a rough shape .... To do this you have to hold the stave firmly in the left hand

across the block ... and with the axe cut a rough list on the stave, working from the centre outwards to the end of the staves, cutting off chippings. The handle of a cooper's axe is offset so that you don't chaff your fingers on the stave (Kilby 1971:21).

Its blade, which is illustrated and photographed in use by Kilby (1971:21, Figures 3–4, Plates 1, 41C) is generally around 26.5 cm long and is designed for precise, exacting work. The haft was offset so that knuckles are not hit by contact with the stave while cutting it (Kilby 1971:78). The French cooper's axes illustrated by Diderot (1966:*Tonnellier*, Figure 3) and Kilby (1971:58, Figure 31) are almost identical to the one from the *Belle* chest.

Two fragments of this type of tool were also recovered from *le Machault*. The more intact fragment exhibited an offset, socketed handle attachment portion, and one side of the blade was completely flat. The head length (the distance from the back of the handle attachment to the bit edge) was 15.3 cm. The second artifact consisted only of a fragment of the round socketed handle (Ross 1981:304, Figure 119).

#### *Draw Knives (11500-15, -16, -28)*

Three draw knives (also known as drawing knives, draw shaves, draft shaves, or shaving knives [Salaman 1975:175; Seymour 1984:96]) were recovered from the chest. Two of these were identical in shape, but differed in size (11500-15 and -16). Those two were wrapped with textile tied with twine to protect their blades. The wooden handles of all three knives were decorated with lathe-turned grooves.

Drawknives were used in many different trades, thus showing their versatility. They could be used “to taper the sides of shingles, to rough-size the edges of floor boards and rough-trim paneling before planning them, to fashion axe, rake, and other tool handles, and to make stool legs, ox yokes, pump handles, and wheel spokes” (Sloane 1964:38–39). Diderot (1966) illustrates many types of drawknives used in a variety of professions. Based on these drawings, the closest comparison for the *Belle* chest's flat knife (11500-28) is from the field of mineralogy, while the closest correlates for the other two knives are found in the professions of wainwright and cooper (Diderot 1966:*Charron*, Plate II, Figure 5; *Mineralogie*, Figure 15; *Tonnellier*, Plate VII, Figure 15).

Coopers used a variety of draw knives in their discipline, including the long backing knife, used to make the convex outer curve of the stave and for leveling the joints (Kilby 1971:82, Plate 49).

Having listed the stave, you must now proceed to *back* it. This is the shaping of the outside, or the back, of the stave. With staves of firkin length or shorter this work is done on a horse. You sit on a horse and grip the stave in a kind of vice-lever operated by the feet, leaving the hands free. With long staves of kilderkin, barrel, hogshead or longer, this job is done on the block, holding the stave by pressing down on the end with your stomach, and keeping the stave wedged between the edge of the block and the hook.... (Kilby 1971:22, Figure 5, Plate 2).



The sharpest of the cooper's knives is the slightly curved heading knife used in cutting the angles on the cask heads (Kilby 1971:Plate 18). The knives from the *Belle* chest are similar to French wine-cooper's heading knives and one flat backing knife, which could have been used in a variety of other woodworking disciplines as well (Kilby 1971:58, Figure 30).

Intact drawing knives generally seem to be rare in the archaeological record, however. Two probable carpenter's drawing knives have been recovered from Port Royal. The overall length of one artifact is 45.5 cm. The blade portion comprises 27 cm of this length. The blade measured 0.79 cm wide along the poll, and the tang tapered slightly from 0.79 cm to 0.64 cm (Franklin 1992:114–115, Figure 96). The other draw knife recovered from Port Royal had a 45-cm-long blade with a maximum blade width of 6 cm, tapering to 2–3 cm at the ends (Custer 2004:161, Figure 102). A single complete wooden handle from *le Machault* is attributed to a draw knife. Its mouth has the impression of the iron as it forms a right angle at the juncture of the blade and tang. The tang hole was rectangular, and the tang had been bent over the heel. The handle's dimensions were 8.9 cm in length with a maximum diameter of 3.9 cm. The tang hole measured 1.3 by 0.9 cm at the mouth and tapered to 0.9 cm<sup>2</sup>. It was ovoid in shape with three groups of three incised lines (Ross 1981:156–157, Figure 48).

#### *Adzes (11500-12, -14, -24)*

Three iron adzes were recovered from the *Belle* chest (Figure 38). One of these is a cooper's adze; the other two may have been small shipwright's adzes, as they have long pins on their polls for driving down nails. Use of the pin prevents the blade from becoming nicked by stray nails. According to Sloane (1964:26–27), this feature is an important diagnostic attribute of the shipwright's adze. The adze was considered a ship's carpenter's most important tool. It had a long blade (often approximately 20 cm), and its handle sometimes featured two curves. When wielded by an experienced craftsman, the tool could shape and finish timbers to nearly the same level of fineness as a joiner's plane (Dodds and Moore 1984:43). The longest adze head from the chest (11500-14) is approximately 13 cm long, so if it is a shipwright's adze, it is a small one. An adze used by pruners or wood carvers is drawn by Diderot (1966:*Taillanderie*, Plate IV, Figure 6). Another adze is illustrated in use on a fresh tree trunk by Kilby (1971:Plate 55). Its poll does not feature a pin. The edge to be sharpened on an adze was inside the head. Heads, therefore, had to be removable from their handles to be accessible to a grindstone.

The cooper's adze from the chest is similar to the drawings from Salaman (1975:25, Figure 7) and Seymour (1984:96). The artifact's blade is narrow and the square, extended poll is hollowed beneath. The poll was used for hammering and was apparently hollowed to reduce its weight (Salaman 1975:25). The eye is rectangular and has a very short handle. This short handle (Figure 39) and the small radius of the blade curvature enabled the cooper, with one hand, to swing the adze inside the cask so that he could

cut the chime bevel or howel surface, a practice most commonly done by the French (Diderot 1966:*Tonnelier*, Figure 6; Kilby 1971:Plate 10; Salaman 1975:25). Adzes that are slightly less curved, called rounding adzes, are also commonly used by coopers (Kilby 1971:30, 78, Plates 10, 41). The 1653 *Vergulde Draeck* requisitions list contained, among many other items, 100 adzes (Green 1977:384–388, Table 6-20).



Figure 38. Comparison in two views of the three adzes from the *Belle* chest. In process photographs of epoxy casts. Top: Adze 11500-24. Middle: Adze 11500-14. Bottom: Adze 11500-12. Photography by J. Swanson.

The *Whydah*, *Defence*, *Machault*, and Port Royal sites all produced partial adzes or adze handles. A severely battered one-handed wooden adze handle was recovered from the *Whydah*. Based on a partial mold of its associated blade, the bit would have been approximately 7.3 cm. Another nearly complete iron adze head from the site is identified as a shipwright's tool (Hamilton 1992:204, Figures 53–54). An incomplete adze handle with a slight S-curve was discovered in the wreckage of the *Defence* (Smith 1986:181). An adze with a curved blade is attributed to a cooper by the archaeologists from the excavation of *le Machault*. The poll percussion face was square in cross section, whereas the eye was octagonal. Wedges for blade security were not found in the circular wooden handle. The dimensions of the head are: length 25.5 cm, bit width 9.5 cm, percussion face width 2.6 cm, and eye diameter 3.5 cm (Ross 1981:307, Figure 121). Three definite adzes were recovered from Port Royal. Measurements on one, attributed to a carpenter or joiner, included: head length 25 cm, curved blade width 13.5 cm by 6.0 cm, length of poll from back of oval eye 7.6 cm, and poll face 3.82 cm across. The second adze,

consisting only of the blade and partial oval eye and attributed to a carpenter or a shipwright, measured: preserved head length 22 cm, blade tip width 5.2 cm. The third adze with a rectangular eye likely belonged to a cooper or sculptor. Its measurements included: preserved head length 15.24 cm, blade width 5.08 cm, and poll face length 5.0 cm (Franklin 1992:30–34, Figures 7–10). Additionally, adzes used on the construction of the Pepper Wreck are hypothesized to have blade widths of 7–10 cm. These measurements were taken from tool marks on the vessel's timbers (Castro 2001:182, Figure VII.35).



Figure 39. Wooden adze handles. Top: Preconservation view of cooper's adze handle. Bottom: Probable adze handle to -12 or -14, discovered disconnected from either head. 1 bar = 10 cm. Photography (top) by M. West and (bottom) by J. Swanson.

#### *Saw, Cooper's Heading (11500-4)*

The cooper's heading saw is a type of a saw that is very similar to a buck saw and is sometimes called a cooper's bow-saw (Figure 40). A buck saw is also known as a woodcutter's saw, a billet saw, or a firewood saw. It has a rigid blade approximately 53–66 cm long, and is set within a wooden frame that has one arm, or cheek, which extends to form a handle. This tool is generally used for cross-cutting wood. Artifact 11500-4 is similar to saws produced in Britain that have a single piece of stretcher wood as well

as a toggle stick and cord for tightening the blade between the two arms (Salaman 1975: 435–436). The blade could be twisted simply by turning the handles, allowing one to easily saw curved pieces (Sloane 1964:66–67). This trait made it a useful tool for cutting out the round heads of casks with its half-inch blade, a task that Kilby (1971:39, 84, Plates 15, 50) claims took time to master. Both Diderot (1966:*Tonnelier*, Plate IV, Figure 27) and Kilby (1971:58, Figure 35) illustrate French cooper's heading saws that are nearly identical to Artifact 11500-4.



Figure 40. Inside view of shorter cooper's heading saw arm. Note both the rectangular mortise for the insertion of the cross piece's tenon and the circular hole for the insertion of the saw blade tang. 1 bar = 10 cm. *Photography by J. Swanson.*

Few shipwreck sites seem to have yielded recognizable frame saw parts, with five fragments from *le Machault* being the notable exception. These included fragments of the lower grip, three upper cheeks, and one complete cheek (total length 48.7 cm, width at stretcher bar hole 6.5 cm, thickness at stretcher bar hole 2.6 cm, stretcher bar hole 0.9 by 3.4 cm, saw blade tang hole diameter 1.4 cm).

The complete cheek was a curved cheek with a rectangular cross-section, a chiseled rectangular stretcher bar hole, a drilled circular saw blade tang hole and lip with a sawn notch for the tension cord. Bow saws of this type, with round saw blade tang holes, were known as turning saws. Historic illustrations of this type of saw indicate that the saw blade was held in place by a slotted cylindrical fastener (Ross 1981:128).

The four fragmentary cheeks from *le Machault* measured as follows: 1) grip extends 10.8 cm below saw blade tang hole, whose diameter is 1.4 cm; 2) cheek width at stretcher bar hole 6.7 cm, cheek thickness at stretcher bar hole 3.0 cm, stretcher bar hole 1.0 by 3.6 cm; 3) cheek thickness at stretcher bar hole 3.2 cm; 4) thickness near tension cord notch 3.1 cm (Ross 1981:128, 130–133, Figures 33–34).

*Square, Carpenter's (11500-23)*

A single iron carpenter's square was recovered from the chest. Each arm ends with an acute angle. Squares have been in use for many millennia and have been recovered from quite ancient contexts (Petrie 1916:XLVII, Figures 58–61). They are used by many occupations that need to form right angles for some aspect of their work. The square most similar to Artifact 11500-23 among Diderot's (1966:*Vitrier*, Plate II, Figure 3) illustrations belongs to a window pane maker. Lead coming for leaded glass windows was recovered from another part of *la Belle*.

*Chinces (11500-43, -44)*

The chince, or flagging or chiming iron, is a tool “shaped like a chisel but with a flattened edge, rather like a shipwright's caulking iron” (Kilby 1971:40; Seymour 1984:119). Two artifacts from the chest that are believed to be chinces were discovered in the chest. The iron of one blade (11500-44) was indistinguishable from the surrounding matrix. Its wooden handle, however, is very similar to Artifact 11500-43, indicating they may possibly be the same type of tool. Artifact 11500-43 has an iron band that encircles the head and foot of the wooden handle. Its blade smoothly tapers to the bit edge (Figure 41).



Figure 41. In process view of blade portion of chince 11500-43. *Photography by M. West.*

In East Asia “caulking irons are sometimes made in the form of stout chisels with flared blades and wooden handles, and are driven by a hammer” (Salaman 1975:118). This form is very similar to the artifacts from the chest. Another similar tool is illustrated in Salaman (1975:122, Figure 188h). This chince was used by the cooper to force flag or rush into the joints between pieces of the cask in order to prevent leakage (Kilby 1971:79, Plate 50; McNerney 1979:117). This tool is also very similar to an

allongee chisel, mostly used by sculptors, and a skew chisel, which is a type of forming chisel. A skew chisel is used in mortise work for cutting away the extra wood left between two auger holes to form the mortise (Sloane 1964:52, 55; Salaman 1975:136–137, Figure 205w). Diderot (1966) also illustrates a number of similar tools. These include one used for inserting glass or mirror within a framework. The tool drawing with the most similar blade is from architectural masonry, while an illustration in mineralogy has the closest handle parallel (Diderot 1966:*Architecture maçonnerie*, Plate XII, Figure 112; *Glaces*, Figure 10; *Mineralogie*, Figure 9).

Archaeologists have discovered a number of tools or tool parts that might be identified as chinces, caulking irons, or similar tools. A number of wooden handles were recovered from the *Vergulde Draeck*. Although none are exact matches for any of the handles found in this chest from *la Belle*, the square tang holes are reminiscent of the wooden-handled chisels (-43 and -44) (Green 1977:267). Port Royal excavations produced two carpenter's framing or firming chisels that are similar to the one from the *Belle* chest: one with a blade 19.7 cm long and a maximum blade width of 6.35 cm, the other with a blade 14 cm long and 6.03 cm wide (Franklin 1992:76–91). A number of caulking irons were also recovered, including a very similar one 17 cm long and 4.9 cm wide whose head had been clearly pounded upon and was slightly mushroomed as a result (Franklin 1992:69–74, Figures 46–53). An additional iron that seems to most closely approximate the blade from the *Belle* chest, artifact number PR 89 612 NP 1A, has measurements of 18.2 cm in length, a head diameter of 2.9 cm, and a blade width of 3.8 cm (Custer 2004: 148–152, Figures 86–90).

Caulking irons without wooden handles, of both the sharp- and single-crease variety, were found on *le Machault* (Ross 1981:206–208, Figure 74). However, one isolated wooden handle very similar to Artifact 11500-43 had a diameter of 3.5 cm (Ross 1981:346, 349, Figure 131). Excavations at Lake Champlain on the 1820s *Eagle* also produced an iron chisel with a wooden handle (overall length 20.48 cm, handle length 7.94 cm, handle diameter 3.02 cm, blade width 4.76 cm). The blade is squared, however, and the wooden handle had no iron reinforcement bands. Otherwise, it is quite similar in form to the ones from the *Belle* chest (Crisman 1987:241, 250, To. 2). Large number of wooden tool handles for chisels were also found upon the Jutholmen wreck (Cederlund and Ingelman-Sundberg 1973:320).

#### *Cold Chisel (11500-8)*

A single cold chisel was recovered from the chest. It has an octagonal shaft and a slightly mushroomed head. Cold chisels were used to cut metal or stone. They were utilized in varying professions, including coopering to cut iron hoop (Kilby 1971:79). Diderot (1966:*Serrurerie*, Figure 96) illustrates one very close to the artifact from the *Belle* chest as a tool. This tool was used by a locksmith. At least 18 chisels were recovered from Port Royal, some socket-fitted and some solid wrought iron. Four of these bear some similarity to this one from *la Belle*. Their measurements are as follows: 1) blade

length 13.65 cm, blade width 1.18 cm; 2) blade length 10.2 cm, preserved width 2.54 cm; 3) blade length 22.9 cm, blade width at tip 2.54 cm; and 4) preserved length 13.8 cm, preserved blade width at tip 3.49 cm, broadening from a shoulder width of 2.54 cm. This last chisel is the closest in form to that from the chest. Although the handle did not survive, its shank is square and the blade is beveled on one side (Franklin 1992:76–91, Figure 63). An additional cold chisel measured 21 cm long and had a shaft diameter of 1.7 cm (Custer 2004:152–153, Figure 91).

#### *Gouges (11500-35, -46)*

Gouges are very similar to cold chisels, except their bit ends are curved into a variety of shapes. One type of bit is spoon-shaped as were these two from the chest. Diderot (1966:*Charpente*, Figure 42) depicts gouges used for framework in carpentry. *Le Machault* excavations also produced one forged and socketed gouge blade with a curved cutting edge and octagonal socket (overall length 23.2 cm, cutting width 2.3 cm). The blade portion is very similar to the *Belle* chest blade, but the socket portion is not (Ross 1981:158–159, Figure 49).

Several possible gouge bits were recovered from Port Royal. One preserved blade bit measures 2.9 cm and has an inner dimension of 2.5 cm (Franklin 1992:82, Figure 60). Two other spoon bits were initially identified as auger bits but may be gouge bits instead. These had square shanks, and so were presumed by Franklin (1992:37–38, Figures 13–14) to have been part of an auger as opposed to a gouge. The *Belle* chest augers have octagonal shanks, as do the gouges, and so Franklin's identification on this premise may be incorrect. The first spoon bit was 13 cm long, with an outer edge 2.8 cm wide and an inner diameter of 1.4 cm. The second bit had a remaining length of 33 cm, a 14 cm long bit, an outer edge 1.9 cm across, and an inner diameter of 1.4 cm.

Two more gouges were recovered from Port Royal. The measurements of one were 16 cm in length, 2 cm in diameter at the cutting end, and 0.7 cm in diameter at the handle end. The other was 18.5 cm long (Custer 2004:153–154, Figures 92–93). Another artifact is identified as a spoon bit auger because of its rounded end and high sides. It is 15.5 cm from the end of the bit to the start of the hilt and has a maximum width of 3.8 cm. The bit walls are about 1 cm high and the handle is 4.3 cm long and 1.8 cm wide. Although the artifact is identified as an auger bit, its surviving part appears nearly identical to at least one of the two complete gouges from the *Belle* chest. It could, therefore, be a gouge bit as well (Custer 2004:142, Figure 79).

#### *Augers (11500-29, -49, -50, -51, -52, -53)*

Several augers were stored inside the chest. A single wooden handle, roughly shaped, was recovered with an iron bit attached (Figure 42). A package of five more auger bits was also discovered wrapped with twine (Figure 43).





Figure 42. Wooden auger handle. (Preconservation). *Photography by J. Swanson.*

An auger usually consists of a woodworking iron bit with a wooden handle. In coopering, one size bit was used to drill the bung holes in cask sides (Kilby 1971:78). The closest parallel to the iron augers in the *Belle* chest seems to be a combination of Sloane's (1964:72–77) bit and Diderot's (1966:*Serrurerie*, Figure 103; *Tabletier cornetier*, Figures 19–23) tang. The former shows bits of the twisted cylinder type, with parallel sides. One of the sides is a cutting edge. The latter shows augers for locksmithery and for shelf/sill making. The tools used for sill making have tangs identical to those from the chest. Most auger shafts usually terminate in a cylindrical hole into which a piece of wood is inserted to act as the handle. The *Belle* bits end with rectangular cross sections and are inserted into the wood, as Diderot shows. The *Vergulde Draeck* requisitions list included some 200 augers, as well (Green 1977:384–388, Table 6-20).



Figure 43. One auger bit from the auger package. Preconservation. *Photography by M. West.*



Auger bits are only occasionally found in archaeological sites. Two augers with iron socket eyes were recovered from Port Royal (Franklin 1992:35–37, Figures 11–12). Excavations at the site of *le Machault* also produced several augers (one with a ring socket) and several handles. None of these handles were the same shape as the one from this chest. Another incomplete iron tool blade with a square shank and rectangular tang (maximum width 2.0 cm) with a square hole punched through it was also recovered from *le Machault*. This tang is essentially identical to the tangs from the *Belle* chest augers (Ross 1981:162–167, 189, 191, Figures 51–53, 66). A spoon bit auger in very good condition and much like the *Belle* artifacts was also found at the *Flota* wreck site. The spoon bit measured 9.5 cm long, 2.4 cm wide, and 0.4 cm deep at the cutting edge. The shaft measured approximately 1 cm wide (Skowronek 1984:158, Figure 95).

#### *Gimlets (11500-5, -9)*

Salaman (1975:208) differentiates the gimlet (also known as a gimblet; nail piercer; nail passer; nail pastor; nailson; and sometimes spout or gutter gimlets) from the auger mainly by its size and shape. Gimlets have a spiral twist or shell body with a screw point. They are used for boring small holes approximately 0.32–0.95 cm in diameter. Initially, the hole is created by squeezing the wood apart. The size of the hole is increased by cutting the sides. It is often also used for pilot holes to start nails and screws. Two gimlets were discovered with the *Belle* chest. Artifact 11500-9 has a handle that is roughly barrel-shaped with tapering ends and a series of lathe-turned hoop-like rings used for decoration (Figure 44). This design is characteristic of a brewer's gimlet, which is used to bore a tapering vent-hole that would then be closed with a spile, a type of tapered peg that acts as a plug (Salaman 1975:208). A small auger bit could also have been used for drilling the tap instead of a gimlet (Kilby 1971:78).



Figure 44. Auger and gimlet wooden handles. Left: Handles. Right: Detail of ends. 1 bar = 2.5 cm. Photography by M. West.

Artifact 11500-5 is a small gimlet with an elongated ovoid handle with rounded ends. Many professions using this type of tool are illustrated in Diderot (1966[23]:*Boisselier*, Plate II, Figure 20; *Coffretier*, *Malletier*, *Bahutier*, Plate I, Figure 8; *Imprimerie*, Plate XIX, Figure 4; *Lutherie*, Plate XVIII, Figure 10; *Serrurerie*, Plate LVI, Figure 102). These professions include the general woodworker, the lockmaker, stringed instrument maker, box, trunk, and round-topped chest maker, and even those in the field of printing works. When necessary, a cooper could use a small gimlet instead of a heading vice. This tool screws into a cask's head and allows it to be lifted up into the groove (Kilby 1971:82, Plate 19).

Egg-shaped gimlet handles have been recovered from a number of 18th-century shipwreck sites, including the *Whydah* and the *Defence* (Hamilton 1992:205, Figure 56; Hamilton and Binder 1992). The artifact from the *Defence* had a pattern similar to that of a brewer's twist gimlet. This type of gimlet is roughly a cross between the two kinds from the *Belle* chest (Smith 1986:182–183, Figure 93). Four small gimlet handles were recovered from *le Machault*. Three had tapering tang holes while the fourth gimlet's tang hole was irregular and well-worn. The dimensions for these are as follows: 1) length 6.3 cm, midpoint diameter 2.0 cm, lower edge tang hole 0.4 by 0.6 cm, upper edge tang hole diameter 0.3 by 0.4 cm; 2) length 8.3 cm, midpoint width 2.6cm, lower edge tang hole 0.4 by 0.5 cm, upper edge tang hole 0.1 by 0.2 cm; 3) length 6.6 cm, midpoint width 2.2 cm; 4) length 6.5 cm, midpoint diameter 2.4 cm, lower edge tang hole 0.4 by 0.6, upper edge tang hole 0.2 by 0.3 cm (Ross 1981:167–169, Figure 54). A small gimlet similar to Artifact 11500-5 was recovered from the wreck of the *Boscawen*, a British ship built in 1759. The tool had a handle length and diameter of 6.8 cm and 2.5 cm, respectively, with an iron shank length of 8.3 cm and blade width of 0.5 cm, the blade ending in either a spoon bit or a pod bit. There are four possible reasons it may have been aboard the *Boscawen*: left in the bilge from the ship's construction; a ship's carpenter's tool; field artillery equipment cargo; or as a cleaning agent for the vents on the ship's guns (Grant 1996:131–133, Figure 26).

Artifact 11500-5 has ownership initials stamped on the wooden handle. This is one of only two pairs of ownership initials on objects from the chest. The letters *WF* are clearly made with pre-formed alphabetic stamps. None of the names of the coopers or carpenters listed in Table 1 coincide with the initials *WF*, nor do these initials match anyone else on the expedition whose name has survived (Appendix E). This suggests two possibilities. First, the name of the owner of this tool may not have survived, as many of the members of the expedition remain nameless to this day. Second, this tool may once have belonged to someone not traveling with the expedition. It may have been willed to, given to, stolen by, or bought by anyone while still in France, and the original owner's initials were possibly never changed. In French the letter *W* is never used as the first letter of a word (including names) unless the word is borrowed from another language. This suggests that this tool belonged to one of the foreigners on board (English, German, Italian, and Spanish [Minet 1987:124; Joutel 1998: 97; Weddle 2001:124]) or else was once the possession of a non-Frenchman, from whom the expedition member obtained it. However, as no

other tools were discovered with ownership initials, it is likely this gimlet did not originate with the other woodworking tools.

### **Conclusions**

The chest holds an assemblage of artifacts whose diversity is unparalleled in other surviving containers from the shipwreck. Heavy lead objects such as the sounding weight and counterweight were tossed into the chest alongside sharp, but fragile, tool blades. The sword hilt pieces were scattered among drumsticks and augers. However, the complete collection still reveals several important points. First, approximately half of the collection consists of woodworking items. About a quarter of the artifacts can be divided among maritime and military items, and the rest are miscellaneous. Second, many of the items made of wood have lathe-turning decoration: all the drumsticks, all the drawknives, the reaping hooks, and the brewer's gimlet. Third, two items have ownership initials, the fork and the small gimlet; these initials do not match one another and perhaps indicate diverse origins for at least part of the collection. Fourth, several items are incomplete. The cattle hook probably had its handle sawn off, perhaps after having been broken; the fishing spear had been completely detached from its handle; the heading saw's blades were not discovered; keys to the locks were not found; and the sword hilt had no blade. The vast majority of artifacts, however, were clearly intact.

It is possible that the chest served to store items that were broken or no longer useful. For instance, perhaps the keys to the locks had been lost and the saw blades ruined. Likewise, the navigational dividers, drawknives, and drumsticks may have been unnecessary as the colony fell into greater trouble. However, additional evidence refutes this idea. Many items in the chest were in good condition (and would have been useful regardless of the colony's woes), such as the hatchet and axe, the sounding lead, the fork, and the cooper's drawknives that were carefully wrapped with cloth and secured with twine. The chest was nailed shut, but the uncertainty of whether these items were the belongings of a single person only amplifies the mystery of the chest's purpose.

## CHAPTER V

### OCCUPATIONS REPRESENTED BY THE CHEST

#### Introduction

An examination of the artifacts found within the *Belle* chest leaves one with a pressing question: Who was the owner of this sundry collection of items? The likelihood of a single person owning such a diverse group of tools belonging to a variety of professions is quite low. A sounding lead, reaping hooks, and a cooper's axe have little in common. The utilitarian nature of a tool often leads one to solely concentrate on *what* that tool can do, instead of *who* the particular person using that tool was. The historical accounts of the hired craftsmen on the La Salle expedition paint the picture of a group of vagabonds who exaggerated their skills and abilities to be paid for two or three years of service in what would hopefully be a bright new colony. Once in the New World, however, they did little work, lost many of their tools, and soon died alongside the other members of the settlement.

The following discussion examines the *Belle* chest's artifacts by group, beginning with the maritime profession of pilot or navigator. Commentary on the naval woodworking jobs of shipwright, ship's carpenter, and caulker will follow, ending with a joint maritime woodworkers' conclusion. This will then dovetail into discussion of the other wood-related professions such as carpentry, joinery, and, especially, coopering. Finally, items that were probably originally used for agricultural or military purposes will be briefly discussed. All numbers in parentheses, such as (-36), indicate the artifact number from the *Belle* chest, as in 11500-36.

#### Ship's Pilot/Navigator

Six artifacts stored within the chest may have been connected with a pilot or navigator's duties. Many sea-going vessels employ pilots to guide their ships. French pilots were in charge of all the navigational supplies, including compasses, timepieces, and sounding leads (Ross 1981:74). A partial navigator's kit was recovered aboard the 18th century privateer *Defence*. This kit included a set of dividers, a Gunter scale, a ball of twine, and a partial Davis quadrant (Smith 1986:169). *La Belle*'s wreck also produced several navigational items, including dividers and a nocturne. The sounding lead (-6) and brass navigational dividers (-34) from the *Belle* chest certainly would have come under the pilot's jurisdiction. French pilots, however, were also in charge of fishing activities to feed the crew. Their advanced knowledge of the ocean and weather patterns enabled them to choose proper locations to cast lines and set nets, as well as the best times to both cast out and haul in the fishing supplies with their catches (Ross 1981:73). It is likely that they also saw to the proper care of this equipment when it was not in use (Aubin 1702:617). The *Belle* chest's fishing sinker (-20), the seven-tine spear (-27), and possibly the large spherical lead (-19) could all have been used for fishing activities. Finally, one item from the

chest, identified as the cattle hook (-32), may have instead been used as a gaff. If this were the case, the gaff could have been used by any member of the crew for many reasons, including grabbing lines of rope that were out of reach (Ross 1981:89). This could have been used during fishing events as well, to pull or grab nets and lines when needed.

### **Shipwright**

La Salle hired a man named Massiot to contract workers for his expedition to Louisiana. Notary records from the tradesmen's contracts list six men hired for the La Salle venture simply as *carpenter*. Weddle (2001:124) suggests that this means they might have been either carpenters or shipwrights. He continues on to imply that the shipwrights were equivalent to the ship's carpenters. Before the 1750s, the term of shipwright covered a much wider range of shipbuilding-related tasks, including mastmaking and boatmaking, before these disciplines became specialized fields (Dodds and Moore 1984:41). With this in mind, it seems probable that Massiot searched for any man who knew the workings of a ship who would consent to travel on this perilous journey. A shipwright would have been ideal in that he could have acted as both shipwright as well as ship's carpenter when needed. A shipwright's expertise would also have been useful in building the small boats or rafts used by La Salle as he explored the areas around Matagorda Bay, still in search of the Mississippi. Massiot may have hired some ship's carpenters (undesignated from the other carpenters on the list) whom he hoped would be able to do general carpentry for the new colony, as well. Jean Morel is likely the only craftsman with the more specialized skills of a shipwright (however poor those skills may have been deemed when they arrived in Texas), as he is the only one stated to be so on the list. However, it is certainly possible that all the other carpenters were combined on this list, whether they were intended for shipboard work or general carpentry. Morel most likely would have held the equivalent of the position of 'master carpenter' over the ship's carpenters in terms of their work.

A master shipwright was the highest position a maritime woodworker could attain. He ensured that the plans for the ship were carefully followed and that work in the shipyard proceeded smoothly. In addition to the master shipwright, however, the shipyard employed many other shipwrights. While their main responsibilities lay with the construction of the hull, shipwrights were also knowledgeable about the duties and skills required of the ship's carpenter and the caulker. The shipwright's tool kit was comprised of many standard tools. The adze was the most important and usually had a blade roughly 23 cm long with a double-curved handle. The tool could be used to finish even extremely delicate works when in the hands of a skilled man. Axes were used for rough work before using the adze, and there would usually be several sizes of each tool within the shipwright's kit. The variety of saws in his kit included handsaws and pit saws, like the rib saw used for curved work. Chisels and gouges were heavier than those used in other woodworking trades, and most had long blades and wide cutting edges, sometimes as broad as 91.5 cm

along the blade. A ship's maul (a hammer with a long handle of approximately 91 cm) had a head weighing between 0.7 and 3.6 kg. This was used for driving bolts, spikes, and treenails. Other items commonly found in a shipwright's collection included a spokeshave, a draw knife, an all-iron splitting-out chisel, smaller hammers, augers, braces and bits, and scrapers. There also likely would have been caulking irons and mallets, although a caulking specialist would have been hired specifically for that aspect of the job (Dodds and Moore 1984:41–44).

Marianne Franklin's (1992) unpublished master's thesis examined the tools recovered from underwater archaeological excavations at the 17th-century maritime city of Port Royal, Jamaica. She assigned a number of tools to a ship's carpenter or shipwright based solely on their form. One adze with a preserved length of 22 cm and a 5.2-cm-wide blade tip is attributed to a carpenter or shipwright because of its great length (Franklin 1992:31–32). Franklin (1992:75–125) also describes possible shipwright's tools among the chisels, iron crow bars, and sledge hammers.

### **Ship's Carpenter**

A shipwright would be just as adept at repairing a ship as in building one, and many shipwrights would leave their jobs in the dockyard to work aboard ships to care for the vessels while afloat as ship's carpenters (Lavery 1991:53). The ship's carpenter's primary duty on a French 74-gun ship was to keep the vessel running smoothly (Boudriot 1986:142). Although the ship's carpenter could be overwhelmed with work after a naval engagement or bad weather, most of his other jobs were smaller tasks associated with the survival and day-to-day running of the ship. Although much later than the *Belle*, a report of the carpenter's duties from the U.S. armed schooner *Revenge* recorded his activities during service in 1810. Many of his responsibilities would likely have been similar aboard any wooden sailing vessel. This also demonstrates the wide range of tasks that a ship's carpenter had to be prepared to do:

He was either building or repairing boxes for the berth deck, repairs to martingale, fishing the main boom, building a hen coop, installing gipes for the gig, building a binnacle, repairing round house, repairing shot boxes, repairing jolly boat, repairs to bowsprit and jibboom, making washboards for the gig, repairing forecastle deck, making a topmast studdingsail yard, making a cooper's shaving horse, repairing cutter, making jolly boat rudder, making mast and sprit for boat, repairs to medicine chest, repairs in forecastle and stateroom, including some new decking, new wardroom lockers and hatch, new lower studdingsail boom, and new flying jibboom (Leavitt 1970:1325).

Although much of the gear and equipment would have been issued by the government in this particular case, it is probable that the carpenter would have also had his own personal tool chest (Leavitt 1970:1323).

The French launched the frigate *Machault* in 1759 as a privateer and, soon after, refit the vessel for convoy duty. She was probably about half the size of the 74-gun ships previously mentioned. *Le Machault* was the flagship of a small fleet sent by the French to drive the British from Quebec, but sank in Chaleur Bay along the southeastern coast of Canada (Sullivan 1986:7–11). Many tools that may have

belonged to a ship's carpenter were on board (Appendix F). Among these tools were a one-piece wooden mallet, a forged strap-iron single-bitted adze, a forged iron or steel saw set (for setting the angles of saw blade teeth), a wooden handle grip and handle plate from single-handed saws, a wood and copper-alloy carpenter's ruler/bevel, wooden handles from shaping tools, and a number of planes, including varieties of jack, tongue, moulding, and compass planes (Sullivan 1984:48). Aboard the 18th-century privateer *Defence* were also a few carpentry tools, consisting of an adze, axes, gimlets, and a possible bow drill (Smith 1986:181).

### **Caulker**

The French regarded carpenters as mainly responsible for structural repair and rebuilding, while conversely caulkers were responsible for hull inspection and keeping the ship watertight (Aubin 1702:146, 194). On the 74-gun French ship, there would not only be a master caulker, but also a caulker's mate (two in wartime) and three caulker's crew (four in wartime). The master caulker's storeroom would have held his tools and various plugs for keeping the ship watertight (Appendix F). Some of these tools would have included a caulking mallet with small slots cut on one side of the head, allowing it to vibrate and guide the caulker in his work. Iron raves would be used to pull out the oakum in old seams, and the caulking irons would be used to drive in the strands of new oakum. Another one of his main duties was to care for the pumps, for if they were not working efficiently, the vessel could have major problems as it slowly took on water over the course of a voyage (Boudriot 1986:144–154). In terms of importance, the caulker was just below the shipwright during the building of a vessel, but caulking was a job that was never finished and continued throughout the life of the ship. The caulker was especially important on a vessel's maiden voyage, as was *la Belle*'s, where seams would open up as the ship settled into herself under the stresses and strains of her first trip out to sea (Dodds and Moore 1984:44–45). Excavations on *le Machault*'s wreck recovered several caulking implements, including caulking irons as well as hardwood caulking mallets, whose heads were reinforced with iron bands on the ends and bolts on each side of the handle (Sullivan 1986:24). Franklin (1992:36–74) acknowledged the difficulty of archaeologically distinguishing caulking irons from chisels, especially when worn down chisels may have been later reused as caulking irons. She identified chisels as only those that had a solid shank with no sign of sharpened and beveled edges on the sides of the blade. At Port Royal, eight such tools of varying shapes were found but with an overall standard width of approximately 0.5 cm among them.

### **Conclusion for Maritime Woodworking Professions**

The *Belle* chest assemblage has a number of items that may have belonged to or been used by these maritime woodworking professions. A possible caulking iron, adzes, a hatchet, drawknives, a chisel, gouges, augers, and a square are all items mentioned in the preceding discussion or in Appendix F as being

useful to one or more of these occupations. However, the chest's adzes (-12 and -14) are slightly smaller than those commonly used by a shipwright, and most of the tools generally would have been extraneous to a caulker's task. The ship's carpenter is most likely to have owned this collection, yet the buck saw (-4), the shape of the drawknives (-15 and -16), and the extreme curvature of one of the adzes (-24) leaves doubt as to whether this woodworking collection would have belonged to him. Whether or not someone designated as a ship's carpenter or caulker worked aboard ship, the ship would still have needed emergency repairs and a way to minimize leakage. Therefore, every ship must have had the majority of these tools available, regardless of who was on board to wield them. Additionally, one must allow for the fact that there may not have been a ship's carpenter on a particular vessel such as *la Belle*. In other words, although the tool assemblage from *la Belle* chest does not highly conform to a ship's carpenter's kit, even if it had, it would be impossible to deduce from the archaeological evidence that one actually existed without the survival of a list of the ship's crew from archival sources. In fact, aboard a vessel with such a small crew as *la Belle*, the likelihood of employing a man specifically for ship carpentry would have been low.

### **Carpenter, Joiner, and Cabinet Maker**

Each woodworking trade had its own specialization, although a number of the trades could have duties that overlapped when the need arose, as it surely must have at La Salle's colony with its high mortality rate. Carpenters usually constructed the main frame of a building, so they generally worked with large boards that were nailed together or connected with simple joints. According to Salaman (1975:114), the carpenter's main tools were usually the following: "larger and basic types of Adze, Axe or Hatchet, Saws, boring tools, chisels and Hammers; and measuring and testing tools such as the Plumb Rule and Level, Chalk Line, and Rule." Joiners, on the other hand, made the fixed internal structures of the house, such as doors and stairs. As the name implies, the joiners fit pieces of wood together into frames without the use of nails.

The joiner's kit had to include not only the everyday tools of the carpenter, but also many specialized Planes, including the range of 60 or more Moulding Planes, including hollows and rounds.... These became a distinctive feature of the joiner's kit. In addition, the kit included fine-toothed Back Saws for cutting joints, Bow Saws for curved work, and a wide range of testing and marking tools (Salaman 1975:114).

The first recorded use of the term *cabinet maker* in England comes from 1681. A cabinet maker specialized in movable furniture and learned skills in veneering, marquetry, and other decorative woodwork (Appendix F). The cabinet maker's tool kit was similar to the joiner's, although he additionally owned special equipment for making furniture (Salaman 1975:114). Finally, a wheelwright constructed wooden wheels for wagons, carts, carriages, and other types of conveyance. Although little mentioned in



the historical records as a primary occupation of woodworkers and not mentioned among La Salle's hired men, a wheelwright would have used such tools as a side axe (hewing hatchet), drawknives, gouges, and chisels (Seymour 1984:90).

At the time of La Salle's planned expedition to the Spanish Sea, craftsmen of many trades were employed at the island of Jamaica. Jamaica's position in the north-central Caribbean made the island an excellent location for expansion-minded European nations to build a settlement. At the time of La Salle's expedition, the colony of Port Royal was England's largest foreign-based port. Its importance as a merchant entrepot was unsurpassed until it was largely destroyed by an earthquake in 1692 (Hamilton 1984). Jamaica's probate inventories are lists of the possessions a person owned upon his death, most containing information about the deceased's occupation. These inventories assessed the price and overall worth of the possessions (Jamaica Public Archives 1674–1716). Examination of the inventories from 1674 to 1716 (minus eight years' worth of records that have been lost throughout time) reveals eight types of woodworkers: carpenters (28 inventories), joiners (10), cabinet maker (1), coopers (12), logwood tradesmen (2), wherry builders (2), shipwright (1), and ship's carpenters (2). It is probable that some men in the general category of 'carpenter' may have been joiners, cabinet makers, or ship's carpenters, as previously discussed. Additionally, probate inventory work for the blacksmith John Philpott of Port Royal who died in 1689 reveals many items with possible correlations to those in the chest (Appendix D). These include many carpentry and coopering tools, but also many other items with correlates in the chest.

A number of inventories included a set of carpenter's tools, staves, hooping material, and excessive amounts of wood. Many wills, however, have few details and can likely be considered incomplete. Many of the woodworkers were not listed as owning any tools, and for many others, the tools were grouped and given a single value. Inventory takers were not always familiar with distinctions of different tools. Sometimes a "p'cell of tools" was the only way they could describe them, and occasionally the parcel contained broken or rusty items and, thus, was assumed to be of less value. Additionally, sometimes the inventory taker was a friend of the family, and if the value of the estate was low, the taxes assessed would also be low. For the inventories that do list tools, varying degrees of specificity often make direct comparisons between collections impossible. Of the 59 woodworkers discovered amongst the probate records, only eight inventories listed specific tools, as opposed to the collective "parcel of tools" found in most. Transcriptions of the tools found in their respective inventories are listed in Appendix D. Only one, John Biggs of the parish of Vere, is listed as a joiner, while the others are all described as carpenters. However not all of the listings may be reliable, as suggested by a study of William Newman's inventory. Newman's list is by far the longest and most detailed. Each item is listed separately and given its own valuation by the inventory takers. There are at least 15 entries for various types of planes on this list. As mentioned, the occupation that most uses a wide variety of planes is the joiner, while the general carpenter will only have a few basic planes, if any. If this holds true, then Newman was obviously a

trained joiner (or, potentially, a trained cabinet maker). The men conducting the inventory were probably unfamiliar with the distinctions between the various woodworkers; to them, because he worked with wood, he was simply a carpenter, regardless of what he could do in reality. Unfortunately, this creates a problem in sorting out the joiners from the carpenters, and perhaps the cabinet makers from this group as well. This, in turn, makes matching the tool lists to occupations an even more difficult undertaking.

Salaman's (1975) publication categorized various craftsmen's tools by occupation. In comparing his work and the Jamaican archival inventories with the assemblage from the *Belle* chest, one still finds that several of the tools are oddly shaped or not found on the lists. These include the drawknives (-15 and -16) and the curved adze (-24), along with the heading saw (-4) (whose one extra-long handle makes it different from the joiner's bow saw). The large number of planes required by the joiner and cabinet maker exist nowhere on the shipwreck. Therefore, although these woodworking tools may have been used for general carpentry, the shapes of some of the tools and the overall composition of the assemblage leaves doubt as to whether a carpenter was the original owner of these artifacts.

### **Cooper**

The cooper "makes wooden vessels formed of staves which are bound together by hoops of wood or iron" (Salaman 1975:155). These vessels were often casks used for shipping and storing goods. The bulge in the staves of the casks gave the containers the same strength as architectural stones have in an arch. The cooper's task was extremely focused, and he generally employed himself solely with this one type of woodworking job. His trade was generally subdivided into three fields: *white* for staved containers such as buckets and tubs, *dry* for meats, produce, and other commodities, and *wet* for wine, water, and other liquids. This last was considered the most specialized of all the coopering trades. Shipboard coopers specifically would have been employed mainly to repair casks and other staved containers such as funnels, mess kits, and treenware. Other tasks would have included retarring cask interiors, replacing staves, sealing seams by chincing flag into joints, and repairing hoops (Ross 1981:303). If a wormhole was found, the cooper would drive a small punch through it, hammer a peg into the hole, and make the area smooth again with his adze (Kilby 1971:55).

The many particular tools he uses makes the cooper's kit easy to differentiate from other woodworking professionals (Appendix F). The late 17th- and early 18th-century probate inventories for Port Royal, Jamaica, assessed a number of coopers. Most of these inventories listed barrel making materials, such as staves, hoops, and completed casks that were given individual values. In all cases, however, the tools were lumped together as "a p'coll of Coopers tooles," which, unfortunately, allows for no direct comparison to the woodworking contents of the *Belle* chest (Thornton 1992:67). However, "almost all of the cooper's tools are made of beech, a fine-grained wood which wears extremely well.... For hafts, or stales, hickory or ash was used, preferably hickory because it is wonderfully resilient, though

ash is a pretty good substitute” (Kilby 1971:31). Several items from the *Belle* chest relate to the cooper’s trade with certainty: brewer’s gimlet (-9), chincing irons (-43 and -44), cooper’s heading saw (-4), cooper’s axe (-33) and adze (-24), and two cooper’s drawknives (-15 and -16). Additionally, the cooper’s plane bench was found lying near the box during the excavation (Appendix A; Figure 45). The chest’s remaining woodworking tools, although by no means attributable as specialized tools for the cooper’s craft, could easily have been used for this job as well.



Figure 45. The chest in situ with the cooper’s plane in the foreground. Called a “saw horse-like feature” in the field notes. *Photograph courtesy of Texas Historical Commission.*

The cask-making process as described below is adapted from Kilby (1971:15–41), whose family had been professional coopers for several generations. All tools mentioned for which equivalents were discovered in the *Belle* chest are italicized within the following discussion.

Once a board has been cut to the proper length and width of the stave, the *cooper's axe*, with its offset handle, is used to list the board, or, in other words, angle and taper the edges of the stave to give the wood its rough shape. The stave is next backed with a *drawing knife* (the longest of a cooper's knives), which consists of shaping the outside (back) of the stave into a convex shape. After the stave is hollowed out on the other side, the edges are then jointed using a cooper's plane. Once the proper number of staves has been prepared and checked for fit, the body of the cask is loosely assembled with iron truss hoops and filled with a bucket of heat and steam to soften the wood. "When the cask is really hot and everything is ready the cry goes up, 'truss oh!' and two coopers team up, or the apprentice will team up with his master, and the firing will commence" (Kilby 1971:26). The emphasis on the need for two coopers may have influenced the hiring of the two coopers for La Salle's expedition, the 26-year-old Pierre Chaigneau and the 22-year-old Pierre La Roche (Weddle 2001:285, Note 15). Whether it was by accident or design that exactly two people were chosen by La Salle, it seems that at least this part of the process required two men familiar with the work. After the full assembly, a bevel is put on the ends of the staves. This is then straightened with a topping plane and a chime cut inside the barrel for the placement of the head of the cask. A cooper uses trial and error to determine the size of head needed. To do this he uses a *compass* and swings it around the inside of the chime until it fits exactly six times, making adjustments with the width of his compass until he is satisfied. A compass mark using this width is next made around the boards that will become the cask's head. The wood is then placed on a saw tub, and the *cooper's heading saw*, also known as the bow-saw, is used to cut round the head. The next part of the job, in which the angles (called basles by the cooper) are cut on the head to make a proper fit, required great skill. "This is done with a *heading knife*, the sharpest and most respected of all the cooper's knives, guarded and tended with the greatest of care by every cooper. Nobody borrows a cooper's heading knife" (Kilby 1971:40). After the side with the shallower basle is completed, the *cooper's axe* is used on the opposing deeper side to remove extra wood to make the knife's work easier. (Kilby emphasizes the need to work with the grain for both the axe and the knife.) Flag, a type of river rush used to seal the seams of casks, is fit around the head as it is put into place. Any flag still visible needed to be forced into the groove with a *chincing iron*.

French wine cask makers in the 18th century used tools that differed slightly from their English counterparts (Kilby 1971:Plates 27–28). The French *cooper's axe* had its own design, mainly diverging in the design of the iron/wood join. French *drawing knives* have much more pronounced right angles in the handle area, and the *bow saw* has a slightly different curvature. The French cooper's rounding adze was identical to the English version, but the French had an additional, more highly curved *cooper's adze* to cut around the inside of the cask to prepare it for the head's groove. These heads were also marked by a

*compass*, but were cut piece by piece with the *bow saw* as opposed to cutting out a single pre-joined unit as the English did. The head's bevel was cut with a *heading knife* on both sides, without the aid of a cooper's axe (Kilby 1971:57–58).

Many of the items from the *Belle* cask appear to be those of a French wine cask cooper. The cooper's drawknives (-15 and -16), heading knife (-28), cooper's adze (-24) and axe (-33), and bow saw (-4) are all identical to those described and drawn by Kilby (1971:57–58) for this profession. Additional tools similar to the chinces (-43 and -44) and brewer's gimlet (-9) are depicted by Salaman (1975:122, 197, Figures 188h, 293b) specifically as cooper's tools. The augers (-29, -49, -50, -51, -52, and -53), cold chisel (-8) (to cut iron hooping), smallest gimlet (-5), hatchet (-17), and additional adzes (-12 and -14) are all tools a cooper would likely have had among his inventory. He plausibly would also have had gouges (-35 and -46) and a carpenter's square (-23), particularly if expected to do the work of a white cooper. Additionally, evidence from the records of various English apprentice indentures from 1554–1646 suggests that a typical cooper's tool kit at this time included a regular adze, a curved adze, a large axe, a hatchet, a heading knife, and a saw. As the jointer was found next to the chest, the only common items from those lists that are missing from the chest are a shave, a croze, a brace, and a large compass (Goodman 1972). This occupation, therefore, accounts for all of the types and shapes of woodworking tools found in the *Belle* chest. However, even including the cooper's plane found near the chest, the most conspicuous tools missing from the box are the multitude of planes the cooper would have used in various parts of his work.

### **Colony Elite**

Two artifacts represent what may have belonged to the colony's elite: the incomplete sword hilt and the scabbard tip (-3). As discussed in the previous chapter, the hilt was found in three pieces: the grip (-37), the guard (-36), and the knuckle bow (-25). The guard, knuckle bow, and scabbard tip (known as a chape) were all made of brass. The former two were probably cast from a mold and then decoratively hand-etched. The guard is very small, not large enough to protect one's hand. The key to identifying this object as an item owned by one of the colony's elite, however, lies in the grip. Its length is very short, and unless it was created specifically for one person, it would be tight in the hand of most men. For most it probably would have been too small to hold for combat purposes. More importantly, the grip is decorated with silver twining that covers its entire surface. The intricate design and the small, tight weave indicate that much time went into its creation and that it would be meant for adornment and display as opposed to combat. Silver would also have been much more expensive than brass or iron. These clues together signify that the original owner was a man of at least some wealth and status.

A man of high status would be unlikely to have carried any of the other items within the chest, although there are two other artifacts indicating at least slight status: the pewter fork (-42) and the

triangular lock (-47). Pewter was relatively inexpensive, however, so this attribution is speculative at best. In Port Royal around this time the market price of pewter was determined by weight. Pewter was often called “poor man’s silver,” but Thornton (1992:99–100) shows its presence in the majority of the probate inventories. The presence of pewter was not correlated to the wealth of the individual, as even those inventories with large amounts of silver always contained some pewter items. The poor and wealthy alike owned materials manufactured of pewter. The other potential status item is the small triangular padlock, with its brass leafing and small design. It could have been used to lock any small box or chest or possibly even a book. Again, however, the possibility of this having belonged to one of the colony’s elite is simply supposition.

### **Soldier**

A small number of items may be attributed to military or defensive purposes. These consist of the musket ball (-26), the four drumsticks (-11, -38, -39, and -40), and the aforementioned sword hilt (-25, -36, and -37) and chape (-3). As discussed previously, the sword parts are unlikely to have been for combat purposes. The one musket ball could have been used for either defensive or offensive endeavors or, conversely, for hunting. The plethora of musket shot found aboard *la Belle*, however, removes the need to attribute any great importance to this single piece. Although its occurrence is peculiar, it was likely accidentally or off-handedly placed in the chest. Its location in the center of the chest, and the probability that the chest was completely sealed from more than particulate contamination after sinking as discussed in Chapter III, means that it was likely a purposeful addition. The four drumsticks had only one perfectly matched pair among them. The diameter and size of these drumsticks indicates they were most likely used for sounding time, either on board the ship or for the approximately 100 paid foot soldiers as they drilled on land. Drums used for sounding time had to be hit hard for the sound to carry to all the troops and, therefore, had to be quite solid. The stick shape is identical to pipe and drum corps “parade sticks” used today by marching bands. The drumsticks could perhaps be instruments of musical creation, but the likelihood is low because of their solidity and the near dearth of drums in European music at this time. Whether examined together or as separate items, especially in light of the other chest objects, these few artifacts are a poor indicator of the owner having been a soldier or other military man.

### **Butcher/Livestock Tender**

One item could be attributed to a butcher or a livestock tender, the beef hook (-32), known in French as the *croc à boeuf*. This item and its possible import has been discussed in Chapter IV. Regardless of whether this item was meant for the guidance of livestock, its presence alone cannot signify that the original owner of the chest was a butcher or a livestock tender.

### **Agriculturalist/Farmer**

The presence of an agriculturalist is only indicated by two sickles (-21 and -22). Apart from their use in harvesting, these sickles could have been used simply in clearing the land, whether for agriculture or for settlement. The only other item potentially of use to a farmer is the hewing hatchet. This could have been used both to clear saplings as well as construct fences to keep out the wildlife and the settlers' own pigs. Again, however, these items are a poor indicator that a farmer held any major part in the chest's original ownership.

### **Conclusions**

Looking at the collection of artifacts from the *Belle* chest as a whole, several conclusions can be made. The presence of a cooper's tool kit is without doubt. This trade is both the only one that accounts for all the woodworking tools as well as the one whose tools most closely approximate the form of the ones from the chest. It is likely, even, that this was a wet cooper, originally trained in the making of wine casks. However, in light of the diversity of trades represented by the chest's artifacts, some tools could have originally also belonged to some of the other woodworking craftsmen. These could then have later been combined with the cooper's tools just like those of the other non-wood-related occupations. Additionally items from both a maritime and a military background compose the next largest groups of artifacts. The former's objects would include the sounding lead, the fishing sinker, the brass dividers, and the seven-tine fishing spear, all possibly attributable to a ship's pilot, while artifacts attributed to the military might include the four drumsticks, the musket ball, and sword hilt. Thirdly, several other roles within the colony are represented: the two reaping hooks for a farmer, the possible beef hook for the butcher or livestock tender, and the broken sword hilt potentially from one of the colony's elite. Finally, a number of items, including the padlocks (-30, -31, and -47), the counterweight (-19), the valve (-45), the thimble (-7), and the fork (-42) could have belonged to people of several different occupations.

The sheer diversity of the assemblage, along with the number of different occupations the artifacts represent, leads one to conclude that the objects in this chest could not have originated with a single occupation or owner. This assumption is backed by the two items with differing ownership initials: the small gimlet and the pewter fork. Most likely, the chest's ownership began with a wine cask cooper, either Pierre Chaigneau or Pierre La Roche. When the owner died, possession of the chest eventually came under the jurisdiction of La Salle, who tended to claim the ownership rights of the items left by the numerous dead, as discussed in Chapter II. While the chest was still at the settlement, La Salle likely had it filled with the items as found inside before its final transport onto *la Belle*.

## CHAPTER VI

### CONCLUSION: THE HISTORY OF THE *BELLE* CHEST NO. 11500

#### Introduction

Based on the evidence accumulated through examination of the chest, combined with research from the firsthand accounts of the La Salle expedition, a strong case can be presented pertaining to the history of the chest and its contents from the time it was loaded onto a vessel at La Rochelle, France, until the time it sank beneath the waters of Matagorda Bay with *la Belle* as its coffin. The following scenario tracks this most likely course.

#### Historical Conclusion

On 23 March 1684, the Sun King of France, King Louis XIV, granted La Salle the items he would need for the voyage across the Atlantic, the planting of his colony, and the planned offensive against the Spanish mines of Nueva Vizcaya. Among the many items were included 30,000 livres of muskets balls, 300 swords and sabers, tools for carpenters and joiners, and hatchets. By early June, La Salle reluctantly realized that his two ships, *le Joly* and *la Belle*, would be insufficient to carry all his supplies, so he hired *l'Aimable* and later *le Saint-François*. Throughout June and July, the colonists and tradesmen came to La Rochelle to join the expedition. The 40 or so hired workers were boarded on *l'Aimable*, as were axes and the craftsmen's tools given to the explorer by the king. The chest of this study's focus was probably among the items placed on the ship, packed with a dunnage of grasses and filled with tools, mostly for coopering. The chest may have been brought by one of the hired men, 10 of whom at least (2 coopers, 7 carpenters, and 1 master carpenter) were woodworkers. These tradesmen later would be vilified by La Salle as "a sorry lot, drawn from the scum of the channel ports and beggars at the church doors, untaught in any craft, intractable to any discipline" (Gaither 1931:248; Weddle 2001:124). Although La Salle was wont to often express his distaste for many people, other firsthand sources do agree with his estimation. It seems likely that, were this chest brought along by a hired woodworker, it could easily have been missing a number of vital tools required for his trade. A man with a few coopering tools might have said he could ply his trade without any real ability to do so when the time came to practice, as La Salle was later to find out. Thus, whether a full complement of woodworking tools from the king or a potentially inadequate collection brought by an unskilled craftsman was originally in the chest cannot be solidly determined.

Having embarked on the voyage at La Rochelle, or perhaps later at the Caribbean island of Saint Domingue, may have been a man with the initials *WF* as found stamped on the gimlet (-5), as well as a man with the initials of *IO*, *JO*, or *OT* as found on the pewter fork (-42). The letter *W* is not one found in the French language as the first letter of a person's name. Therefore, if *WF* boarded with the expedition he



is likely to have been a foreign national or a visitor. Men of a number of other nationalities were a part of the expedition: Italian (Pietro Pauollo di Bonardi, the hired furrier/glover), English, German (such as Jacobus Nicollas, a cannoneer, and James/Heims, a German who became an English pirate), and possibly even a Spaniard, though this is likely confusion on Joutel's part and refers in truth to the aforementioned Italian. The initials scratched into the fork, no matter how they are interpreted, do not directly correspond with the initials of any known person from the expedition, so the person who made those marks may or may not have been a part of the complement. Regardless of ownership and origin, these two items would eventually make their way to the chest.

The chest, likely aboard *l'Aimable* and likely filled with tools, traveled from La Rochelle to Saint Domingue and from there to the Texas coast, probably undisturbed throughout the journey. On 18 February 1685, La Salle ordered the heaviest items on *l'Aimable* unloaded so as to lessen its draft. Cannon, iron, shot, Joutel's trunk, and other heavy items were taken ashore. A craftsman's tool chest filled with its many heavy iron objects would have held high potential to be among these. Joutel does not specifically mention workmen's tools being lost in the partial list of sunken cargo he later gives. After the wreck, the items recovered were primarily gunpowder, wine, food items, and a variety of floating items. These items, along with what had initially been removed from the ship, were gathered to one location where entrenchments were constructed, including a fort made with timber from *l'Aimable*'s wreckage.

In early June 1685, La Salle ordered Joutel to have all but 30 men march by land from the temporary fort to where the explorer wished to build his permanent settlement. As *la Belle* would later transport the bulkier or heavier items, it is unlikely that the chest was carried away from the fort by this group. In mid-July, when *la Belle* arrived, everything except some squared wood was loaded upon the ship. The staging area fortifications consisted primarily of chests and casks, and it was here, much closer to the settlement than Joutel's fort, that over the course of the following weeks *la Belle*'s cargo was unloaded. Men were assigned to move these supplies from the staging area to the settlement.

This cargo traffic toward the settlement lasted at least through August, but in mid-September La Salle reversed his orders, telling Joutel to put his things back aboard *la Belle* as he wanted to take the frigate farther up the bay. A letter later written by La Salle specifically mentions the chests and tools being reboarded. Joutel complied, making several trips to the ship, including one where he also specifically mentions having some trunks. If the chest had indeed been previously removed from *la Belle*, it must have been returned at this time, its final movement before the sinking of the ship four months later. At some point before this final movement, it is probable that the goods inside were removed, rearranged, partially lost or destroyed, and/or simply put into other containers, accounting for both the diversity of the collection and, if originally a cooper's chest, the missing planes and other tools vital for this craft. Once the chest was ready for transport to the ship, it was probably loosely nailed shut to prevent spillage in case the chest tipped over. If this were the case, then the chest was not opened after its arrival back at *la Belle*.

## Final Conclusions

In sum, the following tenets have been proposed in this thesis regarding the history of this intact chest and its contents:

1. The chest was likely boarded on *l'Aimable* and left there until removed around the time of the ship's sinking. It would have remained at the camp until loaded upon *la Belle* for the trip through Matagorda Bay. There, it was probably unloaded to the staging area and then moved to the main settlement. With La Salle's decision to reload *la Belle* with many of the supplies, it probably returned to the staging area and from there to the ship.
2. The chest was likely packed up three times: a) in France before the voyage began (woodworking tools), b) at the initial camp in Texas before its loading upon *Belle* the first time (woodworking tools and possibly other items from the shipwreck), and c) immediately prior to its final return to the ship (when it was probably nailed shut with the assortment as archaeologically discovered).
3. A number of occupations are represented by the assemblage: coopering and possibly carpentry tools, maritime paraphernalia, agriculture implements, military equipment, possibly a gentleman's sword, and other assorted gear.
4. Aside from the sheer diversity of the chest's contents, two items with differing ownership initials, the small gimlet and the pewter fork, suggest this was a collection of items not originally owned by a single person.
5. The chest's ownership probably began with a wine cask cooper, either Pierre Chaigneau or Pierre La Roche. When the owner died, possession of the chest eventually came under the jurisdiction of La Salle, who tended to claim the ownership rights of items left by the numerous dead. The assortment of items within may have been slowly acquired through the additions of the dead's possessions by both the original and subsequent owners or alternatively been gathered all at once by La Salle before sending the chest back to *la Belle*.

Two other general points raised by this study must also be noted. Firstly, no strict standards for the creation of tools existed in the 17th century. Without a system of mass production, the only requirement was that they could perform the job for which they were made. Wooden handles would differ in form, decoration varied, and socket shapes would not be uniform, to name but a few examples. Comparing the artifacts from the chest to the printed sources such as Diderot shows there can be no guide to how a particular tool looked in all its specifics. These specifics often varied greatly between the individuals who made similar tools.

Secondly, occupational labels when gleaned from historical records must be used with care. Skilled artisans sometimes pursued multiple types of activities and employments. The strict guidelines and regulation by the guilds of apprenticeship, craft, and craftsmanship were also never completely effective, so terms used to describe the skills and identity of the craftsmen are not always clear. Additionally, references to specific terms can be misleading through both falsehood in self-labeling (as with many of the craftsmen from the expedition who claimed skills they did not possess) and vagueness in ascribing labels (as with the inventory takers in Jamaica). Although European society in the late 17th century was of a strict hierarchical nature, the ambiguity of these crafts' labels also serves to illustrate the occupational and perhaps social heterogeneity within the society as well.

The plethora of artifacts discovered within and about *la Belle* in Matagorda Bay tells not the single story of La Salle's failed venture to conquer and cultivate North America's most important river basin system. Rather, these artifacts tell the myriad stories of the men, women, and children who followed La Salle on his fatal journey. Together, they form a microcosm of the expedition. Pierre Chaigneau, Pierre La Roche, and the other people who chose to bring overseas from their homeland the items found in this chest may have left little else in the world than this testament arisen from its watery grave; however, these pioneers' participation in Texas' past changed New World history and can now be remembered by a few of their possessions. One can well imagine cooper Pierre swinging his trusty adze, the pilot Tessier sounding the bay with his lead, or volunteer and gentleman Le Gros carrying his decorative sword by his side. Through the work of today's archaeologists and historians, these representatives of the lost French colony of La Salle will always be performing those tasks in the minds of this and future generations.

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## APPENDIX A

### TEXAS HISTORICAL COMMISSION FIELD NOTES: ARTIFACT NO. 11500

*December 5, 1996*

*Grid Square: 2016N, 2010E*

*Excavation Level: 30-40 cm*

*Unit Summary Field Notes by DLH*

This unit contains several large concretions which were mapped in w/ the total station. Points taken are indicated on drawing. These artifacts were drawn, mapped and removed. It is possible that these pieces relate to the rigging. They are in line w/ the remains of the main mast and may have fallen.

The remains of Box Fea. #9 were also mapped (photo also), drawn, and removed. The concretions mentioned above may have collapsed on the box crushing it. Also, this box may have contain[ed] red ochre. A large amount of this material was found and collected from the inside of the box.

Another box was also partially excavated. Box Fea. #10 and Artifact #3419. Both are heavily concreted and will take some time before they can be removed.

Lastly, Artifact #5107 is another cleat. It is apparent by wear marks that this object fell from the main deck. It too is concreted down and will take more time to remove.

*January 18, 1997*

*Texas Historical Commission*

*La Salle Shipwreck Project*

*Field Notes for Dr. Jim Bruseth*

*Pages 73-74*

Amy and Greg worked in unit N2017/E2010, and also began to map in and record Box Fea. #10. They had planned to remove one side of the box to investigate its contents and to see if it warranted jacketing with plaster or rather if it should be excavated in the field. The bottom portions of the box are concreted, and this makes it difficult to remove the top or side. They were able to move the top slightly to view inside and noted that there were iron tools with wooden handles. It is my thought since the box contains iron tools that we should jacket it with plaster and remove it intact for the Texas A&M lab to investigate it.

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*January 19, 1997*

*Texas Historical Commission*

*La Salle Shipwreck Project*

*Field Notes for Mike Davis*

*Page 478*

Layne H. and Aimee G. Worked together on Box Feature #10. We had peeked inside the day before when Greg C. was working on it and found that it seems to be full of metal hand tools some of which have wood handles. They assigned Artifact # 11500 as they began work. The interior is quite concreted and the outside is concreted in several places. The two of them worked for a while on the exterior concretion holding the box in place and then a decision was made that we could get it loose and therein jacketing with plaster was the best approach to insuring the 'capture' of the box. They worked for several hours jacketing and finally it was ready for an attempt at removal. We were going to use crane to try to break it loose, but at the last minute decided that we could probably loosen it with several people just pulling manually on lifting straps. This worked quite nicely with two major benefits – we could in the direction that we wanted (and this is not always possible with crane because of the limited angles it can pull) and we could better control the amount of pressure being applied (the control of the crane's brute strength is somewhat tentative). The capture was spectacular – the box came out like a charm and it is now bound for TAMU where it can be excavated in a more controlled setting.

It was necessary for Layne and Aimee to do some lateral cutting adjacent to Box Feature #10 to get it out and in the process they identified a cask abutting the box on its south side. Inadvertently, two of the upper staves of this cask were dislodged and eureka! It is full of adze heads that are in nothing less than an immaculate state of preservation. I assigned Cask Feature #72 to the container.

Bad news when Box Feature #10 came out. Instead of lying on top of ballast, it is lying on top of two and possibly three other casks. At least one of these is one of the small cask that we have been finding lead shot in. Where is the bottom of the deposit on the starboard side. The only positive aspect of this continuation of cultural materials that there still seems to be some room for the cannons that we are all praying for.

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*January 19, 1997*

*Texas Historical Commission*

*La Salle Shipwreck Project*

*Field Notes for Aimee Green*

*Page 591*

Today Layne Hedrick and I worked on jacketing box feature 10 in Main 1. This artifact (box) has a lovely handle which was packaged separately in lieu of jacketing.

First, we put water pre-soaked paper towels over the parts of the wood which were exposed. Next we mixed up plaster of paris, and cut up 2 burlap bags removing the seams. We coated these with the plaster and layered them onto the box, overlapping them and rubbing their seams to seal them.

We used the pneumatic chisel, towel and manual hammer and chisel to define the edges of the box. In doing so we discovered that there were two other heavily concreted casks underneath it, one containing some iron artifacts. We also removed a few staves of cask feature #72, south of the box discovering it to be full of a heads. These are in pristine condition-amazing to look at. There does not appear to be any sediment inside it and they look just as they did when they were packed 300 years ago. (Great exhibit idea!)

Anyway, the inside of the box was so heavily concreted that we had difficulty finding its edges. We put straps around part of it and four or five crew members pulled on them and it popped right out.

It was very exciting to be involved in this jacketing process!

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*January 19, 1997*

*Texas Historical Commission*

*La Salle Shipwreck Project*

*Field Notes for Layne Hedrick*

*Page 757*

Working in unit 2016,2010 on Box Fea. #10 (Artifact #11500). This box was completely intact including a handle on the port side. Aimee G. and I jacketed the top west north side and part of the east south side. We next under cut the Box Fea. 10. The eastern end was heavily concreted to a cask feature found underneath the box and no room was available to maneuver to free this end. I decided to use straps and try and free the eastern end. With the help of Mike D., Stefan C., and Chuck M. We pulled the box free and moved it to a palette. The palette was next moved to the lifting basket and up to the loading dock.

The box was lifted with little or no damage to the feature. Some damage was done to the saw horse-like feature east of the box. The wood of this feature is tremendously waterlogged and does not hold its shape very well. With all the people involved the damage could not be helped. The damage was not heavy, but noticeable. Likewise Cask Fea. 72 aft of Box Fea. 10 was damaged somewhat due to the use of heavily concreted and completely concreted. While working the concretion free two staves came loose and exposed the contents. Inside were many ax-heads. They were slightly concreted together but remarkably identifiable. If they were made of iron then the cask must have been water tight to keep them protected from the salt water because they had not eroded away.

After removing Box Fea. 10, two other casks were found and one other, which already had a feature number was re-uncovered. Cask Fea. 72 which contained the ax heads, had another cask just starboard of 72. This case is probably very similar to 72 and contains trade items or tools. Reasoning follows that they were probably stacked with cask 72 on top and upon wrecking they fell to port. Another small cask was found directly under Box Fea. 10. Nothing could be determined about its contents.

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*January 20, 1997*

*Grid Square: 2016N, 2010E*

*Excavation Level: 30-70 cm*

*Unit Summary Field Notes by Amy Mitchell and Greg Cook*

Box Fea. #10 was lying laterally in relationship to the orientation of the ship. This feature was approx. 45 cm long and 20 cm wide and deep with one handle on its port side. Inspection inside the box revealed only one cylinder wooden handle. Other concretions were noticed, but no excavation was carried out so no further determinations could be made. The decision was to jacket the box and remove it in one piece. Amy Green and Layne Hedrick took care of this responsibility. Before removal, the box was photographed, drawn and mapped in with the EDM. Afterwards the box was jacketed with plaster and removed. Paper towels were used as protection between the plaster and the surface of the wood.

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## APPENDIX B

### ARTIFACT CATALOG

Each artifact entry is divided in the following manner:

Artifact number and identification.

Drawing or photograph, if available.

*Description:* Describes artifact characteristics, including material composition, shape, and special markings.

*Function:* Describes the purpose of the artifact, if known.

*Measurements:* Basic measurements of the artifacts, given only where scales are not clear/present in photographs/drawings.

*Conservation Method:* List of chemicals used for individual artifact conservation. Further details on the method used for each type of artifact are discussed in Chapter III.

*La Salle Expedition References:* References to similar items, mostly from primary texts.

*Archaeological References:* References to other sites with similar artifacts.

*Additional References:* References to other historical or descriptive works mentioning similar items. Note that references from Appendices E (Jamaican Woodworkers' Tools) and F (Woodworking Tool Lists by Occupation) are not included. Some additional references not mentioned in the text are also included here.

***Chest (No. 11500-1)***



*Photography by A. Borgens.*

*Description:* Wood chest composed of 10 separate wooden pieces held together with iron fasteners and hinges. Iron inset plate lock on front, but lid nailed shut. Plate lock attached with four nails and clenched on the inside of the box.

*Function:* Mobile container for storage of tools and other paraphernalia. Originally for a single person who held the key to the lock, later used as general storage with the lid nailed when moved far.

*Measurements:* See scales in Figures 15-17.

*Conservation Method:* Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (80%)/MTMS crosslinker (20%) solution. Cleaned with MTMS. Catalyzed with DBTDA. Iron: No iron fastenings survived.

*La Salle Expedition References:* Cox (1905:221); O'Donnell (1936:14–15); Weddle (1973:171, 185, 199, 258; 1991:29); Joutel (1998:87, 101–102, 107–108, 111)

*Archaeological References:* Cederlund and Ingelman-Sundberg (1973:320, Figure 13); Sullivan (1986); Einarsson (1997:213, Figure 4); Marsden (1974:Figure 28, No. 98); Richards (1997); Stanbury (2003:135 – [box lock])

*Additional References:* Thornton (1992:113–114, 163–165, Figure 42 – [second reference for box lock]); Tools and Trades Historical Society (1994: 27–28, Figures 3.3–3.4, 3.6)

*Dunnage (No. 11500-2)*



Approximately half of the dunnage recovered. *Photography by J. Swanson.*

*Description:* Approximately three dozen pieces of grass and very small twigs.

*Function:* Originally meant to cushion items inside the chest, though the few remnants recovered likely were left from a previous packing.

*Measurements:* See scale.

*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* None discovered.

*Additional References:* None discovered.

*Chape (No. 11500-3)*



*Photography by J. Swanson.*

*Description:* Single piece of brass rolled into ovular cone-shape with a small spheroid of brass on the end.

*Function:* Used at the end of a scabbard to protect the tip.

*Measurements:* See scale.

*Conservation Method:* Electrolysis (solution of 5% sodium hydroxide). Boiling rinse in deionized water.  
Immersion in 3% benzotriazole (BTA) in ethanol. Coated with Krylon Clear Acrylic 1301.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Marx (1967:273); Skowronek (1984:112, Figures 58A–58B)

*Additional References:* Diderot (1966:*Fourbisseur*, Plate IV, Figures 44, 47, 50–51, 56)



*Cooper's Heading Saw (No. 11500-4)*



1 bar = 10 cm. Photography by J. Swanson.

*Description:* Also called cooper's frame saw; three piece wood frame with fixed blade (cannot be turned)

*Function:* Sawing the jointed pieces of cask heads into a circular shape

*Measurements:* See scale.

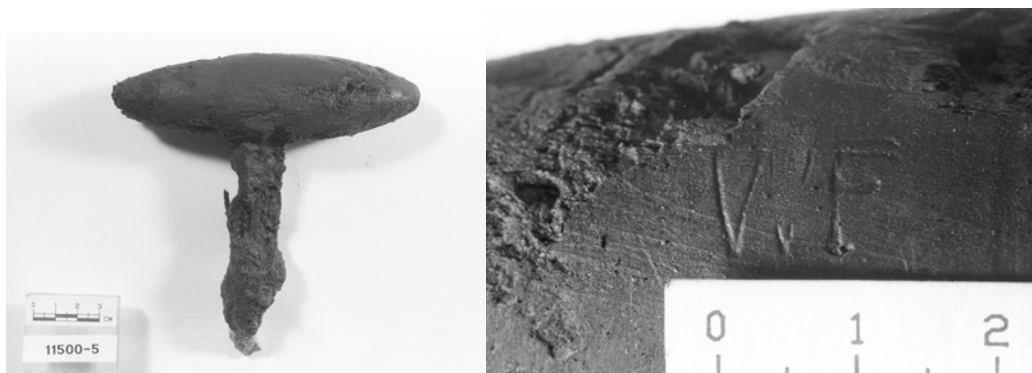
*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (80%)/MTMS crosslinker (20%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Ross (1981:128, 130–133, Figures 33–34)

*Additional References:* Petrie (1916:44, L); Sloane (1964:66–67); Diderot (1966:*Tonnelier*, Plate IV, Figure 27); Kilby (1971:39, 58, 84, Figure 35, Plates 15, 50); Salaman (1975:413, 435–436, Figure 607)

***Gimlets (Nos. 11500-5, -9)***



Small gimlet. Left: Preconservation view. Right: Stamped Initials “W F.” Photography by J. Swanson.



Brewer's gimlet, 11500-9. Photography by A. Borgens.

**Description:** (-5): Also known as gimblet, nail piercer, nail passer, nail pastor, or nailsin. Miniature auger with handle forming a ‘T’ with the shank. (-9): Also known as spile gimlet; stout body; handle turned in the shape of a barrel and decorated with hoop-like rings. Diamond-shaped brass washer over which tang of iron bit could be bent.

**Function:** (-5): Used to bore small holes, including pilot holes; starts by squeezing apart material and finishes by side-cutting. (-9): Used to bore tapered vent-hole in a shive (flat bung), which is then stopped with a spile (tapered peg).

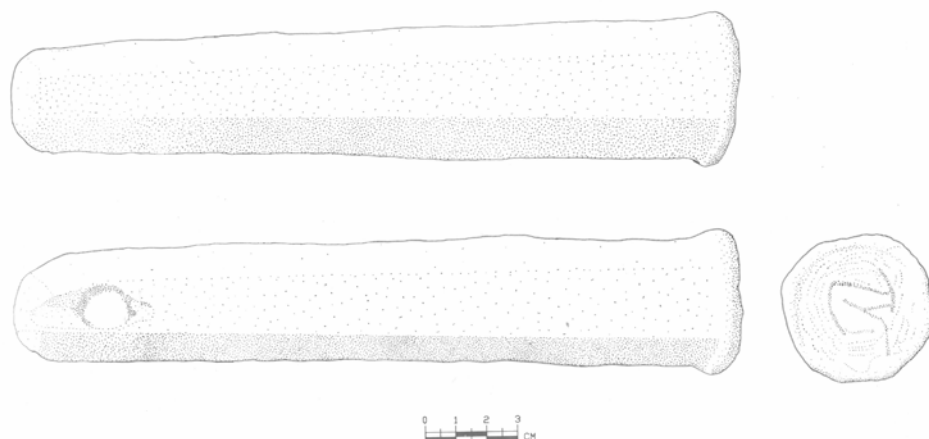
**Conservation Method:** Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA. Iron: Epoxy Hysol cast made of original's remains. Brass (-9): Electrolysis (solution of 5% sodium hydroxide). Boiling rinse in deionized water. Immersion in 3% benzotriazole (BTA) in ethanol. Coated with Krylon Clear Acrylic 1301.

**La Salle Expedition References:** Minet (1987:124); Joutel (1998:97)

**Archaeological References:** Pell (1949:169); Grimm (1970:87); Stone (1974:298, 305); Hanson and Hsu (1975:107); Hogg and Batchelor (1978:frontispiece); Ross (1981:167–169, Figure 54); Smith (1986:182–183, Figure 93); Neumann and Kravic (1989:265); Broadwater (1996:L-5, L-6); Grant (1996:130–133, Figure 26); Hamilton (1992:205, Figure 56); Hamilton and Binder (1992)

**Additional References:** Sloane (1964:72–73); Diderot (1966[23]:Boisselier, Plate II, Figure 20; Coffretier, Malletier, Bahutier, Plate I, Figure 8; Imprimerie, Plate XIX, Figure 4; Lutherie, Plate XVIII, Figure 10; Serrurerie, Plate LVI, Figure 102); Pargellis (1969:482–485); Kilby (1971:78, 82, Plate 19); Salaman (1975:208–209, Figure 311, #1960); Hummel (1976:83)

***Sounding Weight (No. 11500-6)***



*Drawing by M. West.*

**Description:** Octagonal lead still retaining part of its length of rope. One end tapered toward the eye for the rope and at its opposite end was a depression with many deep, haphazard grooves. These grooves would have better enabled the wax to adhere to bottom samples obtained as the lead hit the sea floor.

**Function:** Determining the depth of the sea floor in shallow waters. Grooves better enabled wax to adhere to lead and obtain bottom samples.

**Measurements:** See scale.

**Conservation Method:** Submersion in 10% hydrochloric acid. Boiled in ammonium acetate. Boiling rinse in deionized water. Submerged in microcrystalline wax.

**La Salle Expedition References:** O'Donnell (1936:19); Minet (1987:90, 95, 105, 108, Note 48); Foster (1998:288); Joutel (1998:63–66, 69–70, 74–75, 87); Weddle (2001:149)

**Archaeological References:** Cederlund and Ingelman-Sundberg (1973:321, Figure 15); Price and Muckelroy (1974:263); Sténuît (1974:231–232, Figure 13; 1977:111, Figure 5); Dethlefsen et al. (1977:325, Figure 12); Green (1977:209–211); Pernambuco de Mello (1979:219); Keith et al. (1984:56, Figure 12); Rodríguez-Salgado (1989:Figure 12.20); Hamilton (1992:223–224, Figures 83–84); Redknap and Besly (1997:200–201, Figure 11)

**Additional References:** Weddle (1973:54; 2001:264, Note 13; 1987:134); Green (1977:384–388, Table 6-20); Ross (1981:75)

***Rope (Nos. 11500-6.2, 27.2)***



Rope from sounding lead. Preconservation view. *Photography by A. Borgens.*

*Description:* Rope from sounding lead and from fishing spear. Former's rope is S-twist. Latter's rope was woven around the tines.

*Function:* Sounding lead rope used to lower and lift weight. Spear rope used to hold tines in place and to retrieve implement after being thrown at prey.

*Measurements:* See scale.

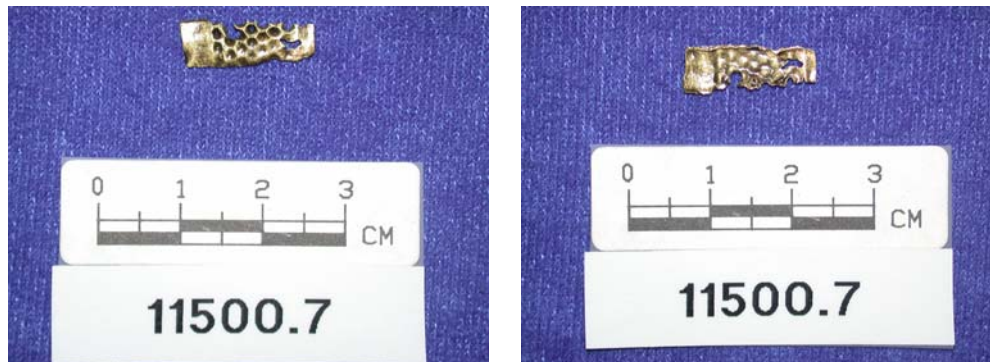
*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Price and Muckelroy (1974:263); Sténuit (1977:111, Figure 4)

*Additional References:* Green (1977:384–388, Table 6-20); Seymour (1984:124)

***Thimble (No. 11500-7)***



Left: Outside. Right: Inside. *Photography by J. Swanson.*

*Description:* Small fragment of dimpled brass that may have been part of a sewing thimble.

*Function:* Finger protection during sewing activities

*Measurements:* See scale.

*Conservation Method:* Electrolysis (solution of 5% sodium hydroxide). Boiling rinse in deionized water. Immersion in 3% benzotriazole (BTA) in ethanol. Coated with Krylon Clear Acrylic 1301.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Marx (1967:303); Cederlund and Ingelman-Sundberg (1973:320); Bax and Martin (1974:90); Larn *et al.* (1974:75–77, Figure 13); Price and Muckelroy (1974:264; 1977:204, Figure 16); Pernambucano de Mello (1979:219–220, Figure 12); Blake and Green (1986:18, Figure 17); Sullivan (1986:92); Throckmorton (1986); Hall (1996:194); Van Holk (1997:224–225, Figure 9)

*Additional References:* Diderot (1966:*Tailleur d'Habits*, Figures 10–11); Seymour (1984:348)

***Cold Chisel (No. 11500-8)***



Preconservation view. *Photography by M. West.*

*Description:* All iron, octagonal shaft, parallel sides, sharpened with one bevel, shank offset to enable blade to be used close to surface

*Function:* Strong enough to be struck with a mallet, cutting off the tops of wedges, or for rough work in carpentry, military work, wagon building, etc.

*Measurements:* See scale.

*Conservation Method:* Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Franklin (1992:76–91, Figure 63); Custer (2004:152–153, Figure 91)

*Additional References:* Petrie (1916); Diderot (1966:*Serrurerie*, Figure 96); Kilby (1971:79); Salaman (1975:130, 146, Figure 219)

***Brewer's Gimlet (No. 11500-9)***

*See entry under that of 11500-5.*

***Small Stick (No. 11500-10)***

*Description:* Small stick of eroded wood.

*Function:* Unknown. Dunnage?

*Measurements:* 6.2 cm length, 0.9 cm width

*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (80%)/MTMS crosslinker (20%) solution. Cleaned with MTMS. Catalyzed with DBTDA.



*Drumsticks (Nos. 11500-11, -38, -39, -40)*



1 bar = 10 cm. *Photography by M. West.*

*Description:* Four large, solid drumsticks. Two (-11, -38) are identical with rounded tips and butts. The other two have flat butts and elongated tips, but -39 is much longer than -40. This longest drumstick is also the only one without lathe-turned decoration.

*Function:* Likely military or maritime in nature, for beating time and giving audible instruction that carries over long distances. Also used by the colonists to frighten native tribes.

*Measurements:* See scale.

*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

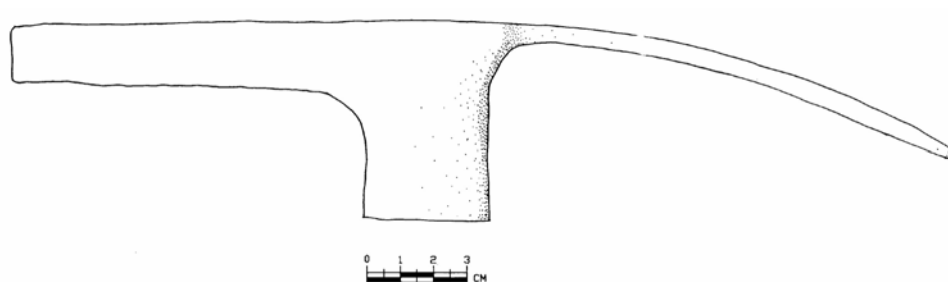
*La Salle Expedition References:* Bell (1987:242); Joutel (1998:88)

*Archaeological References:* None discovered.

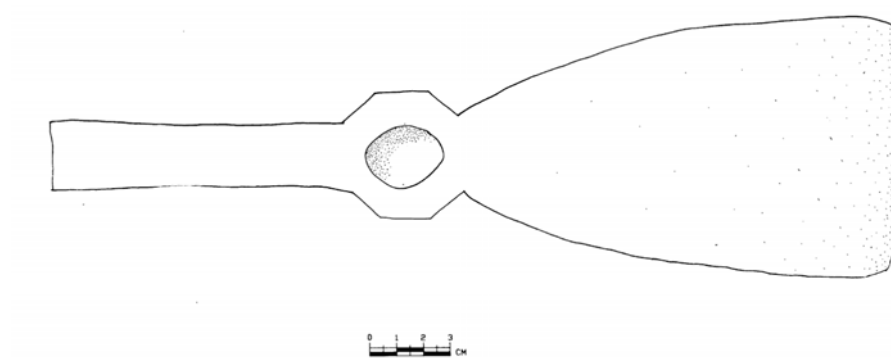
*Additional References:* Green (1977:234); Ross (1981:39); Skenbäck (1983:68–70)



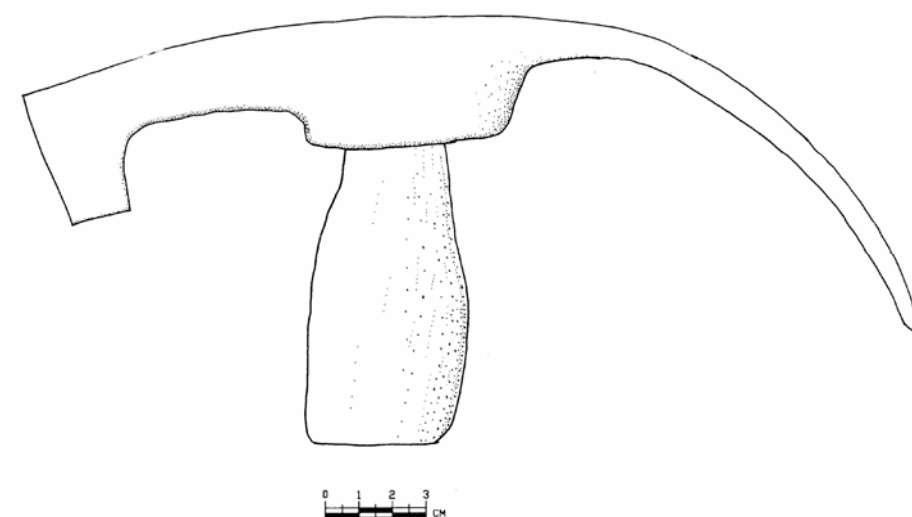
*Adzes (Nos. 11500-12, -14, -24)*



11500-12. *Drawing by M. West.*



11500-14. *Drawing by M. West.*



11500-24. Cooper's adze. *Drawing by M. West.*

*Description:* (-12, -14): Iron adze with poll and wooden handle; blade set at right angle to handle.  
 (-24): Iron cooper's adze with poll and wooden handle; very short handle used to swing one tool inside the radius of a cask; narrow blade; square poll; hollowed underneath to reduce weight; eye is rectangular and tapering

*Function:* (-12, -14): Blade used to shape wood by removing heavy waste, leveling, shaping, and trimming timber surfaces, poll used as nail punch or spur.  
 (-24): Even stave ends; cut chime bevel around inside edge of barrel top; cut howel surface; poll hammers barrel hoops down

*Measurements:* See scale.

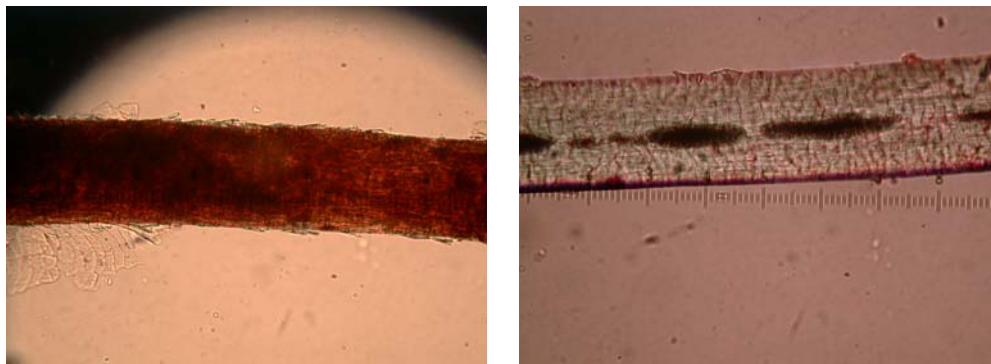
*Conservation Method:* Iron: Epoxy Hysol cast made of originals' remains. Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* Joutel (1998:105)

*Archaeological References:* Ross (1981:307, Figure 121); Smith (1986:181); Franklin (Franklin 1992:29–34, Figures 7–10); Hamilton (1992:204–205, Figure 53); Castro (2001:182, Figure VII.35)

*Additional References:* Moxon (1677:119); Petrie (1916); Mercer (1960:95); Sloane (1964:26–27); Diderot (1966:*Taillanderie*, Plate IV, Figure 6; *Tonnelier*, Figure 6); Hummel (1968:43–44); Kilby (1971:30, 78, Plate 10, 41, 55); Salaman (1975:23–25, Figure 7); Green (1977:384–388, Table 6-20); Arbor (1981:27); Clay (1984:56); Dodds and Moore (1984:43); Seymour (1984:96)

***Hair (No. 11500-13)***



*Photography by V. Bryant and M. West.*

*Description:* Small tuft of short hairs, possibly human.

*Function:* Unknown. No discernible association with other artifacts.

*Measurements:* All very short, less than 1 cm each.

*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Ross (1981:209, 213)

*Additional References:* Hicks (19--:3-4); Trevor-Deutsch (1970:4, 7); Moore et al. (1974:24)

***Adze (No. 11500-14)***

*See entry under that of 11500-12.*

***Drawing Knives (Nos. 11500-15, -16, -28)***



Top: 1 square = 2.5 cm. Bottom: Preconservation view of smaller cooper's drawing knife (11500-16). *Photography by M. West.*

*Description:* (-15, -16): Curved iron blade fitted with wooden handles.

(-28): Straight blade; bevel ground on one edge; tapered tangs at each end of blade are bent at right angles to the blade and fitted with wooden handles, over which the ends were clenched

*Function:* (-15, -16): Removes unwanted timber from back and inside of staves; pares the bevel surrounding the heads

(-28): Removal of waste wood; rounding and chamfering; often used for smoothing surfaces after the adze or axe

*Measurements:* See scales.

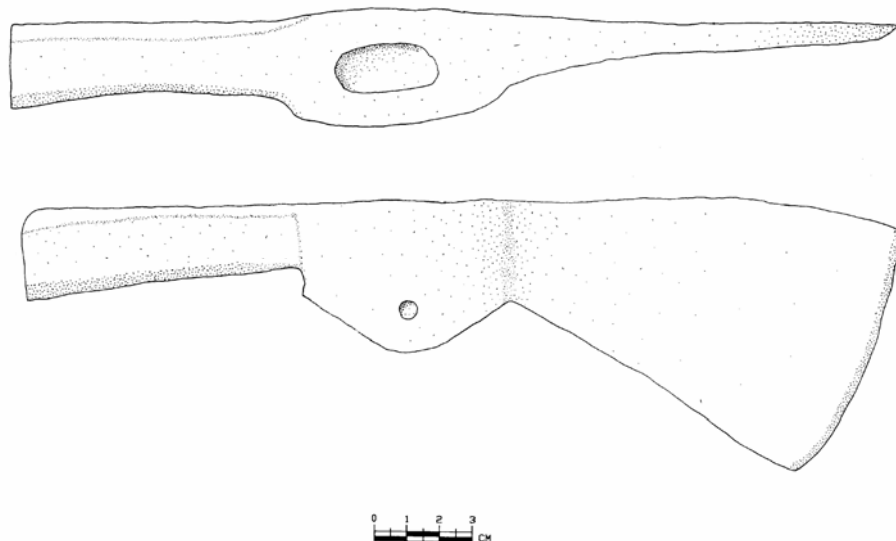
*Conservation Method:* Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA. Iron: Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Green (1977:267); Ross (1981:156–157, Figure 48); Franklin (1992:114–115, Figure 96); Custer (2004:161, Figure 102)

*Additional References:* Sloane (1964:38–39); Diderot (1966:*Charron*, Plate II, Figure 5; *Mineralogie*, Figure 15; *Tonnelier*, Plate VII, Figure 15); Kilby (1971:22, 58, 82, Figures 5, 30, Plates 2, 18, 49); Salaman (1975:175–176, Figure 262a); Seymour (1984:96)

***Hewing Hatchet (No. 11500-17)***



*Drawing by M. West.*

*Description:* Also called a chopper; cutting edge beveled on one side only

*Function:* A light axe, used for rough-surfacing, splitting, chopping, and nailing; used for squaring up round timbers

*Measurements:* See scale.

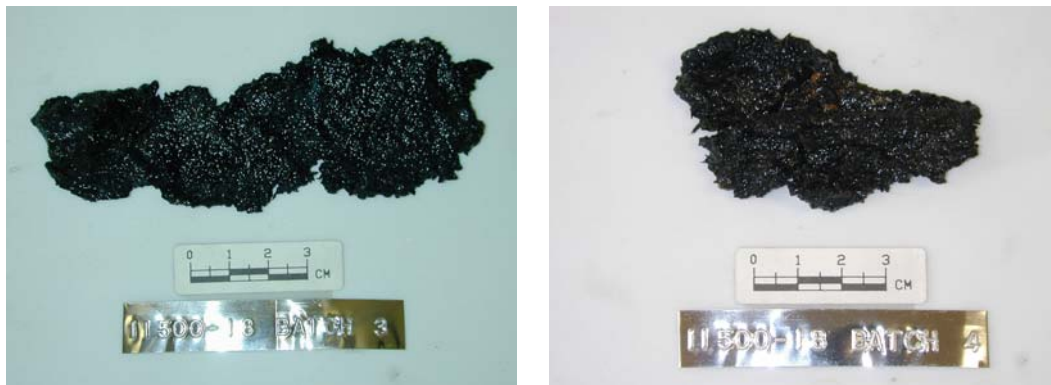
*Conservation Method:* Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (80%)/MTMS crosslinker (20%) solution. Cleaned with MTMS. Catalyzed with DBTDA. Iron: Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* Cox (1905:187–188); Bell (1987:251); Joutel (1998:79, 89, 92, 133, 149)

*Archaeological References:* Cederlund and Ingelman-Sundberg (1973:320); Skowronek (1984:156, 160, Figure 97); Smith (1986:181–182, Figure 92); Franklin (1992:43–61, Figures 17–40); Hamilton (1992:205); Bratten (1997:193–194, 299, Figure A.31, 302, Figure A.35); Feulner (2002:70, Figure 5)

*Additional References:* Petrie (1916); Mercer (1960:86); Sloane (1964:18–19, 21); Diderot (1966:*Ceinturier*, Figure 24); Salaman (1975:63, Figure 91, 238)

***Textile (No. 11500-18.2)***



Textile from the drawing knives' wrapping. Preconservation view. *Photography by M. West.*

*Description:* Textile, possibly canvas or sailcloth, secured with twine around the cooper's draw knives.

*Function:* Used to protect the blades of the draw knives from possible damage through contact with other tools.

*Measurements:* See scale.

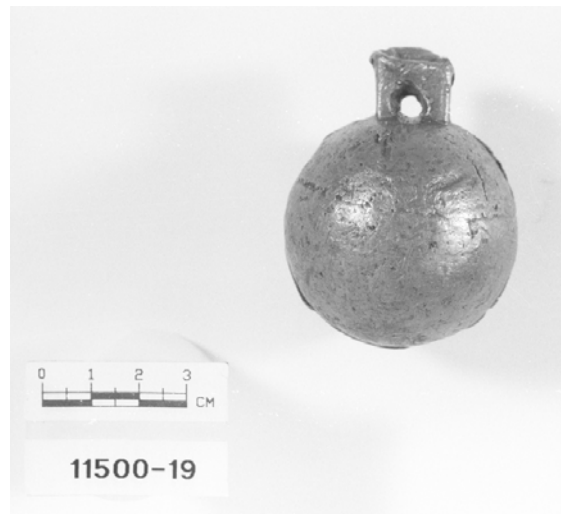
*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Brøgger and Shetelig (1971:94); Cederlund and Ingelman-Sundberg (1973:320); Bengtsson (1975:33); Sténuit (1976:226, 228, Figure 7); Ingstad (1982); Redknap (1984:75–83, Figures 44, 46); Westheden Olausson (1988); Harvey and Binder (1992); Clifford (1993:174–180, Figures 35–36); Cooke et al. (2002:204)

*Additional References:* Green (1977:384–388, Table 6-20); Seymour (1984:174–180)

***Counterweight (No. 11500-19)***



*Photography by J. Swanson.*

*Description:* Spherical lead with a flash line and large sprue through which a hole had been drilled.

*Function:* Unknown, probably a counterweight, possibly a sounding lead, net lead, plumb bob, or pump well sounder.

*Measurements:* See scale.

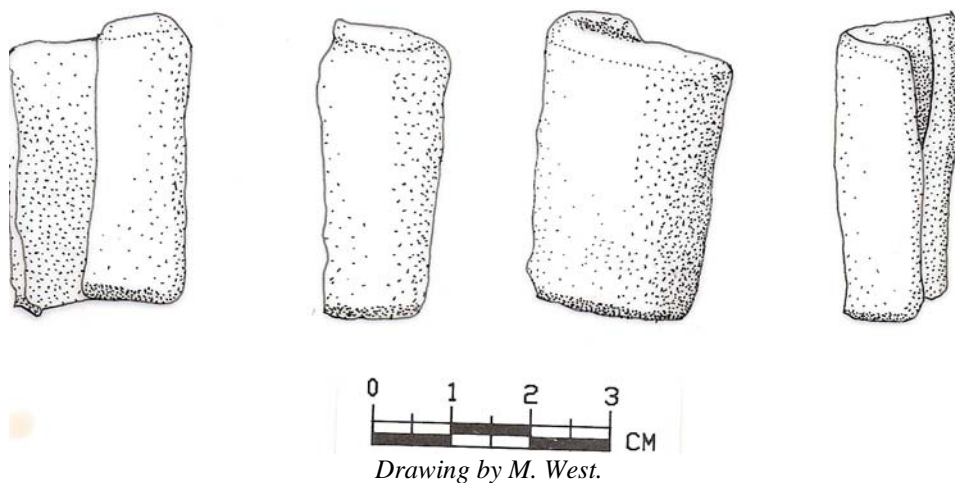
*Conservation Method:* Submersion in 10% hydrochloric acid. Boiled in ammonium acetate. Boiling rinse in deionized water. Submerged in microcrystalline wax.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Brownsword and Pitt (1986); Hamilton (1992:224, Figure 85); Hamilton and Binder (1992)

*Additional References:* Petrie (1916:42, XLVIII); Diderot (1966:*Tourneur*); Short (1968); Butler (1974); Salaman (1975:380); Ross (1981:286); Brownsword and Pitt (1983a; 1983b); Oertling (1996:57, 60, Figure 41)

***Fishing Sinker (No. 11500-20)***



*Description:* Rolled flat piece of lead.

*Function:* Probably used for sinking nets by further bending the lead around its individual lines.

*Measurements:* See scale.

*Conservation Method:* 10% hydrochloric acid; ammonium acetate; microcrystalline wax.

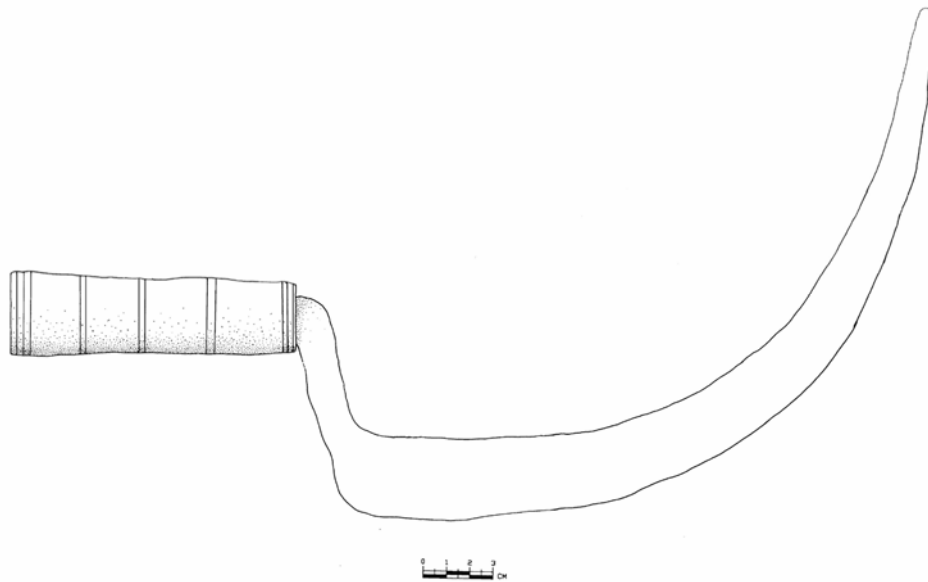
*La Salle Expedition References:* None discovered.

*Archaeological References:* Galili et al. (2002:183–187, Figure 2b, Table 1)

*Additional References:* None discovered.



***Reaping Hooks (Nos. 11500-21, -22)***



11500-21. Drawing by M. West.

*Description:* Non-serrated iron blades with cylindrical wooden handles. Iron tangs clenched over far ends. Wooden handles have lathe-turned decoration.

*Function:* Harvesting thatch, wheat, or other tall grasses.

*Measurements:* For -21, see drawing scale. For -22, wooden handle measurements are

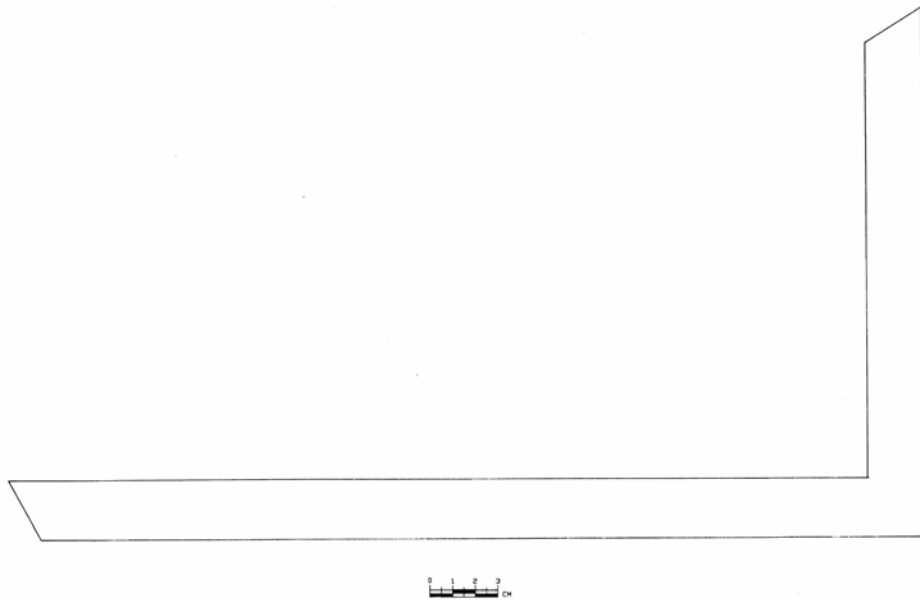
*Conservation Method* Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA. Iron: Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Green (1977:267)

*Additional References:* Petrie (1916:LIV, Figures 1–37); Sloane (1964:100–101); Diderot (1966:Agriculture, Figure 3); Seymour (1984:54, 82)

***Carpenter's Square (No. 11500-23)***



*Drawing by M. West.*

*Description:* Two legs at 90 degree angles to one another, one leg shorter than the other

*Function:* Marking out, testing accuracy of workpieces, and testing the angle of structures in building work, such as setting out roofing, staircases, and other carpentry framing

*Measurements:* See scale.

*Conservation Method:* Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

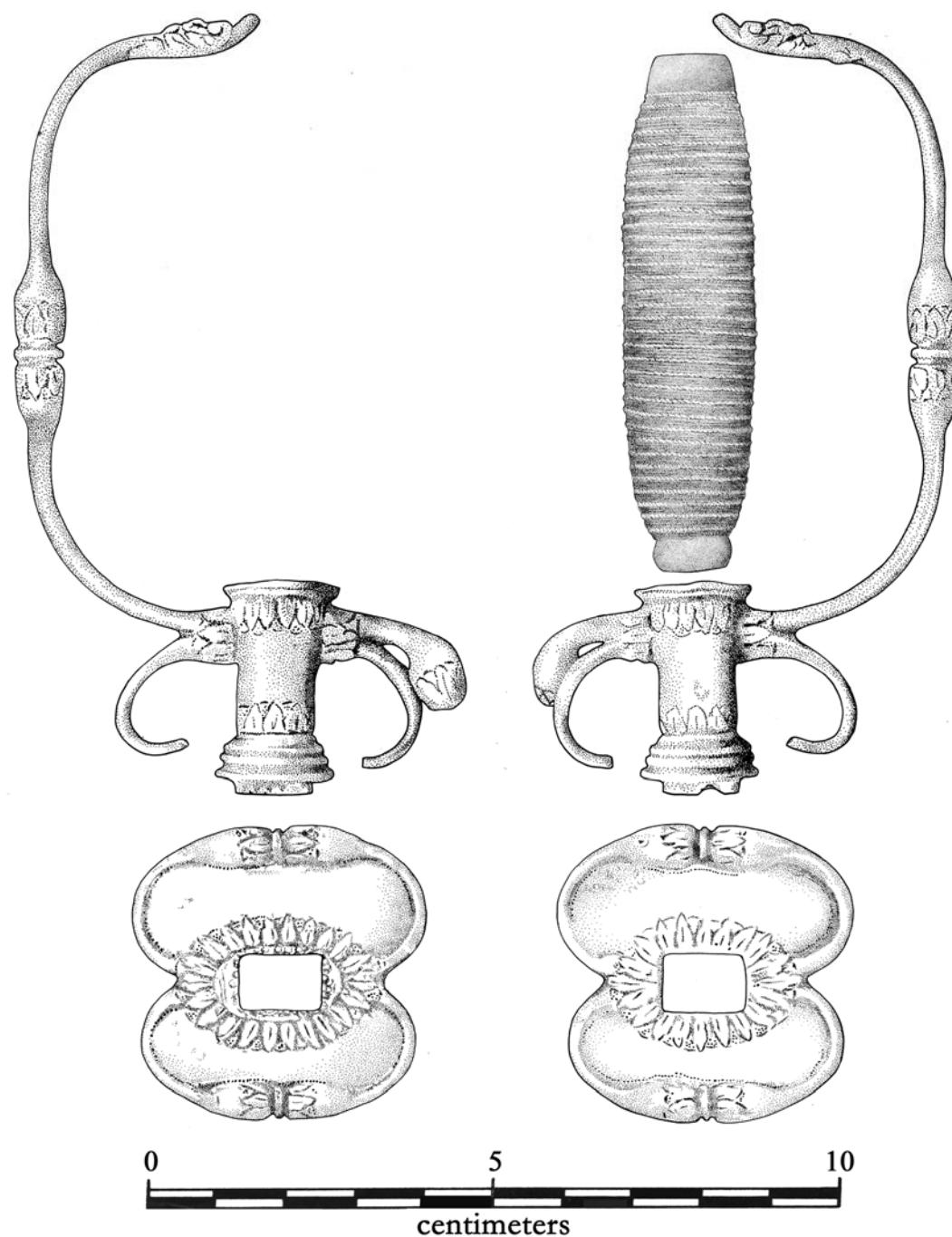
*Archaeological References:* None discovered.

*Additional References:* Petrie (1916:XLVII, Figures 58–61); Diderot's (1966:Vitrier, Plate II, Figure 3); Salaman (1975:472, 475, Figure 692)

***Cooper's Adze (No. 11500-24)***

*See entry under that of 11500-12.*

*Sword Hilt Components (Nos. 11500-25, -36, -37)*



*Drawing by A. Borgens.*

*Description:* Three components to a small sword hilt. Knuckle bow (-25) and guard (-36) made of brass and decorated with acanthus leaf patterning. Grip made of wood with 34 large silver twist braids each separated by three rows of smaller silver twist braids. Components discovered separately within chest, but clearly fit together as a single unit.

*Function:* Sword used for combative purposes or as a status symbol.

*Measurements:* See scale.

*Conservation Method:* (-25, -36): Electrolysis (solution of 5% sodium hydroxide). Boiling rinse in deionized water. Immersion in 3% benzotriazole (BTA) in ethanol. Coated with Krylon Clear Acrylic 1301. (-37): Wood and silver through silicone oil process as a unit. Silver conserved separately after. Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References (Swords):* Cox (1905:187); O'Donnell (1936:17, 19); Bell (1987:227)

*Archaeological References (Knuckle Bow):* Smith (1965:116); Marx (1967:275); Sténuît (1972:Figure 21); Cederlund and Ingelman-Sundberg (1973:320); Bax and Martin (1974:87, Figure 9); Piercy (1977:342, Figure 12.A); Skowronek (1984:100, 103, Figure 51, 106, Figure 53, 108, Figure 55); Sullivan (1986:43); Owen (1988:289, Figure 3); Hamilton and Binder (1992)

*Archaeological References (Guard):* Bax and Martin (1974:87); Piercy (1977:342); Skowronek (1984:100, 106–108, Figures 53–55); Owen (1988:289, Figure 3); Hamilton and Binder (1992)

*Archaeological References (Grip):* Sténuît (1972: Figure 21); Cowan *et al.* (1975:287); Marsden (1976:206–207, Figure 4); Green (1977:267); Skowronek (1984:100, 107–108, Figures 54–55); Owen (1988:289, Figure 3); Hamilton and Binder (1992)

*Additional References (Knuckle Bow):* Diderot (1966:*Fourbisseur*, Plate IV, Figures 44, 47, 50–51, 56); Green (1977:388–392); Thornton (1992:168)

***Musket Shot (No. 11500-26)***



*Photography by J. Swanson.*

*Description:* Single small piece of musket or pistol lead shot.

*Function:* To shoot game or people, or to put in cloth bag with other shot for shooting out of a cannon.

*Measurements:* See scale.

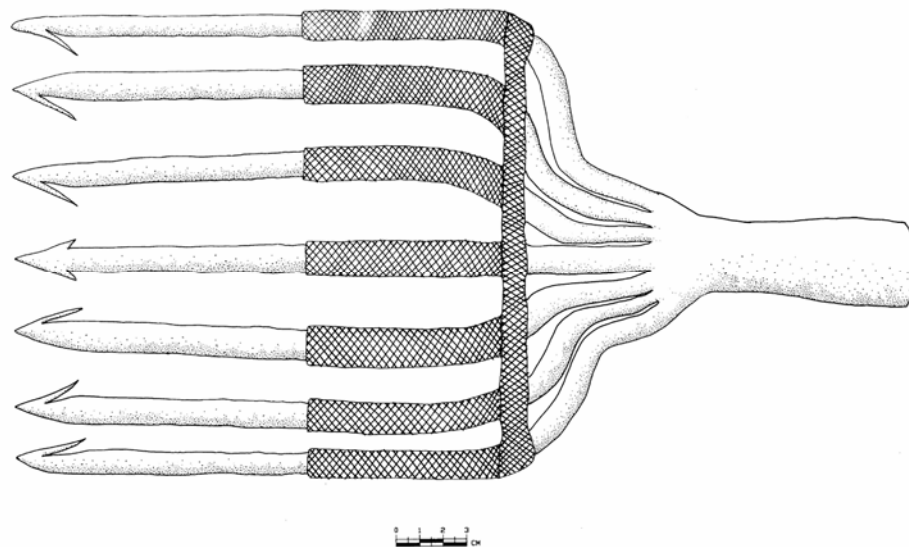
*Conservation Method:* Submersion in 10% hydrochloric acid. Boiled in ammonium acetate. Boiling rinse in deionized water. Submerged in microcrystalline wax.

*La Salle Expedition Primary Source References:* Cox (1905:187–188); Joutel (1998:80); Weddle (2001:186, 294, Note 20)

*Archaeological References:* Martin (1972:65, Figure 5; 1975:Plates 6a–b); Price and Muckelroy (1974:263); Sténuit (1974:224–225; 1977:112–113); Dethlefsen et al. (1977:325); Keith *et al.* (1984:55–56, Figure 11); Redknap (1984:48); Crisman (1987:240, 249, Sh. 4); Clifford (1993:260–261, Figure 76); Bratten (1997:193, 299, Figure A.31); Redknap and Besly (1997:201, Figure 12); Stanbury (2003:132)

*Additional References:* None discovered.

***Fishing Spear (No. 11500-27)***



As the weave of the rope around the tines was unclear, the position alone is indicated by the cross hatching in the drawing. *Drawing by M. West.*

*Description:* Large spear with seven evenly-spaced parallel tines and an iron socket. Six outer tines each had a barb that pointed downward and toward the center tine. The center tine had a double-barb. Knotted rope was woven around each of the tines and the flared end of the socket.

*Function:* Fishing, generally used to catch small whales, large fish, dolphins, and eels.

*Measurements:* See scale.

*Conservation Method:* Iron: Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* Joutel (1998:100)

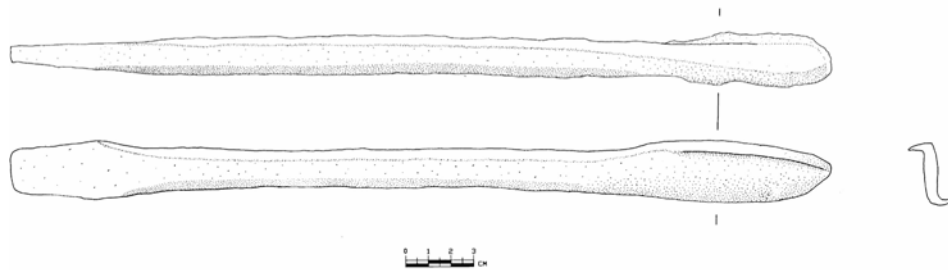
*Archaeological References:* Ross (1981:287, 289–191, Figures 115–116); Pulak (1998:210–211, Figure 23)

*Additional References:* Petrie (1916:32, 57, LXXII); Diderot (1966:*Pesches de Mer*, Plate XVI, Figure 3); Sullivan (1986:52)

***Carpenter's Drawing Knife (No. 11500-28)***

*See entry under that of 11500-16.*

***Auger (No. 11500-29, -49, -50, -51, -52, -53)***



11500-49. Drawing by M. West.

*Description:* Bit (cutting part) at the end of an octagonal shank ending in a tang.

*Function:* Basic boring tool, used for boring large holes by hand.

*Measurements:* See scale for bit. All bits vary only slightly from the drawn example.

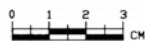
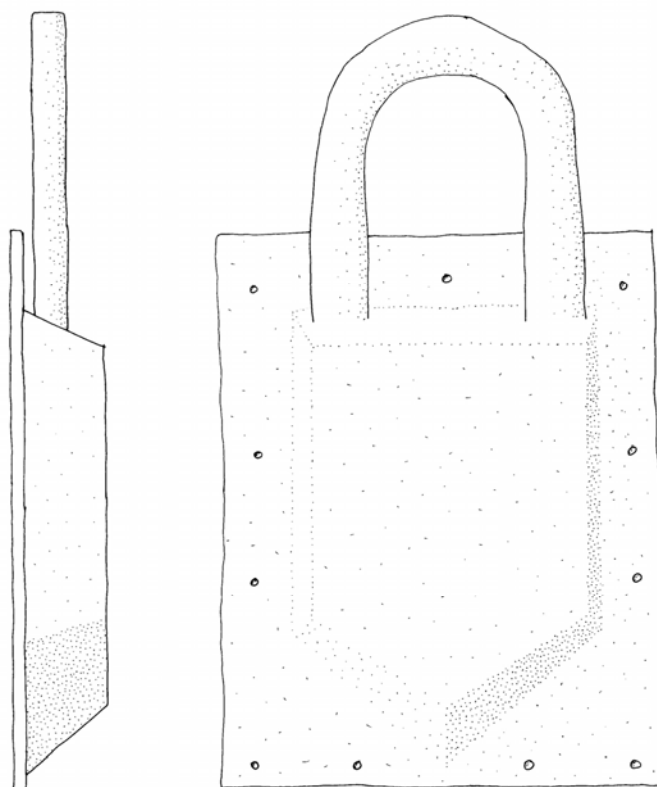
*Conservation Method:* Iron: Epoxy Hysol cast made of original's remains. Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Ross (1981:162–167, 189, 191, Figures 51–53, 66); Skowronek (1984:156, 158, Figure 95); Franklin (1992:35–37, Figures 11–12)

*Additional References:* Petrie (1916:39, XLIII); Sloane (1964:72–77); Diderot (1966:*Serrurerie*, Figure 103; *Tabletier cornetier*, Figures 19–23); Kilby (1971:78); Salaman (1975:31–44, Figures 29–49); Green (1977:384–388, Table 6-20)

*Shackled Bolt Locks (Nos. 11500-30, -31)*



11500-30. *Drawing by M. West.*



11500-31 in situ. *Photography by M. West.*



*Description:* Large padlock-like locks. The bodies of the locks join seamlessly with a flat backing with multiple holes for attaching to something with nails or screws.

*Function:* Unknown. Possibly used for locking chain.

*Measurements:* See scale in drawing of -30.

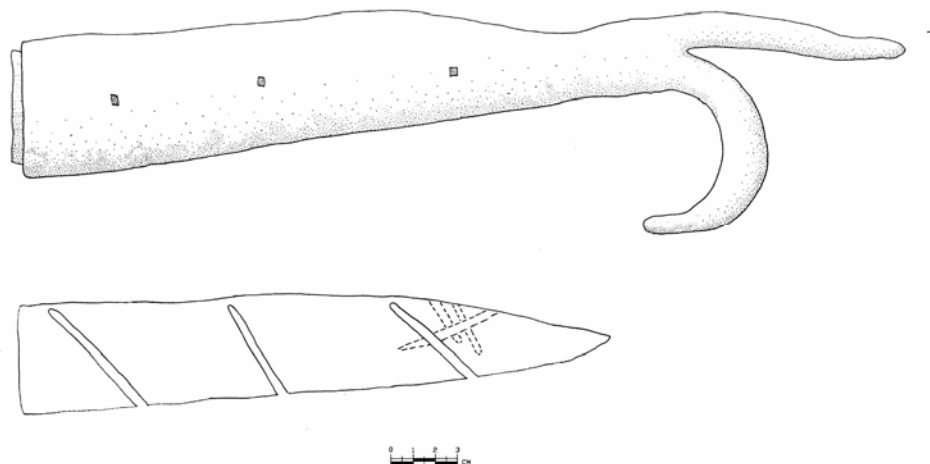
*Conservation Method:* Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Skowronek (1984:90, Figure 39)

*Additional References:* Eras (1957:83, Figure 142); Thornton (1992:163–165, Figure 42)

***Cattle Hook (No. 11500-32)***



*Drawing by M. West.*

*Description:* Probably the French *croc à boeuf*. Iron hook and slightly bent straight tine branch from an iron sleeve attached to a sawed-off wooden handle with at least six nails, probably three original and three for repair.

*Function:* Unknown, though probably for cattle handling/butchery. Potentially also a gaff for maritime use.

*Measurements:* See scale.

*Conservation Method:* Iron: Epoxy Hysol cast made of original's remains. Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* None discovered.

*Additional References:* Petrie (1916:57, LXXI, Figures 50–51); Diderot (1978:331, Figure 16); McNerney (1979:137)

***Cooper's Axe (No. 11500-33)***



1 bar = 1 cm. Left: Iron portion, preconservation. Right: Wooden handle, preconservation.

*Photography (left) by M. West and (right) J. Swanson.*

*Description:* Also called a cooper's hatchet; thin, flat, T-shaped blade; offset handle to prevent user from grazing knuckles; cutting edge of blade forms an angle of approximately 15 degrees from the axis of the handle.

*Function:* Trimming staves, rough-shaping outline of heads, chopping away bevel on heads.

*Measurements:* See scale.

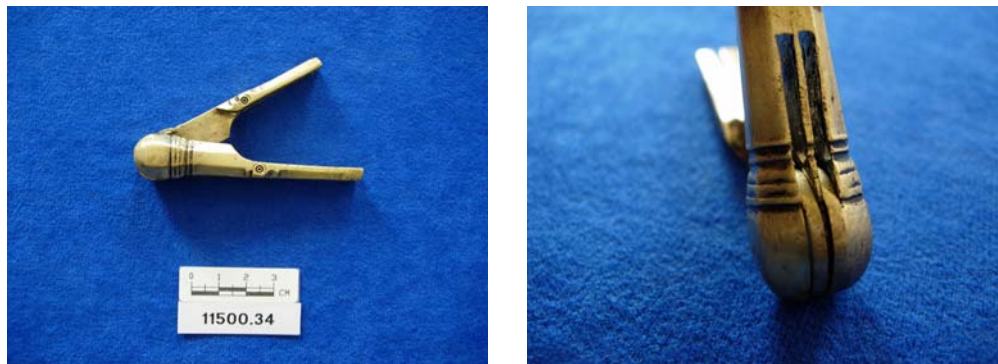
*Conservation Method:* Iron: Epoxy Hysol cast made of original's remains. Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Ross (1981:304, Figure 119)

*Additional References:* Sloane (1964:20–21); Diderot (1966:*Tonnelier*, Figure 3); Kilby (1971:21, 58, 78, Figures 3–4, 31, Plates 1, 41C); Salaman (1975:51); Seymour (1984:96)

***Dividers (No. 11500-34)***



*Photography by J. Swanson.*

*Description:* Two straight legs with grooves at the ends for the insertion of iron tips (not found). Legs connected at one end by a ball joint. Entire piece made of brass.

*Function:* Principally for transcribing measurements and describing circles for navigational and drafting purposes.

*Measurements:* See scale.

*Conservation Method:* Electrolysis (solution of 5% sodium hydroxide). Boiling rinse in deionized water. Immersion in 3% benzotriazole (BTA) in ethanol. Coated with Krylon Clear Acrylic 1301.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Marx (1967:265); Price and Muckelroy (1974:264, Figure 6); Martin (1975:Plate 14); Green (1977:195); Sténuît (1974:232–235, Figures 14–16; 1977:111–112, Figure 6); Muckelroy (1978:124, Figure 3.33); Pernambucano de Mello (1979:218–219, Figure 10); Ross (1981:81–82, Figure 13); Lizé (1984:125, Figure 4); Morris (1984:257); Skowronek (1984:161, Figure 98); Smith (1986:169–171, Figure 84); Owen (1988:289); Einarsson (1990:293–294, Figures 15, 17); Dobbs and Price (1991:120, Figure 13); Muncher (1991:339); Hamilton (1992:219–220); Erwin (1994:141, 229, Figure C-67:b); Redknap and Besly (1997:198–200, Figures 9–10); Brigadier (2002:36–37, Figures 7–8); Custer (2004:158–161, Figures 99–101)

*Additional References:* Moxon (1677:104); Petrie (1916:LXXII, Figures 212–221); Diderot (1966:*Architecture Maçonnerie*, Plate XI, Figure 74; *Charpente*, Figure 22; *Ébéniste*, Figure 85; *Fleuriste artificiel*, Figure 6); Kilby (1971:58, 80, Figure 34); Salaman (1975:152); Franklin (1992:96); Kean (1998:99)

***Gouges (No. 11500-35, -46)***



Top: -35. Bottom: -46. Preconservation views. 1 bar = 1 inch at top of ruler. *Photography by M. West.*

*Description:* Hollow-bladed chisel, similar in appearance to firmer chisel except with a hollow blade; octagonal shaft, very heavy gouge

*Function:* For all general hollowing work, strong enough to be hit with a mallet

*Measurements:* See scales

*Conservation Method:* Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Ross (1981:158–159, Figure 49); Franklin (1992:37–38, 82, Figures 13–14, 60); Custer (2004:142, 153–154, Figures 79, 92–93)

*Additional References:* Petrie (1916); Diderot (1966:*Charpente*, Figure 42); Salaman (1975:212)

***Sword Hilt Guard and Grip (No. 11500-36, -37)***

*See entries under that of 11500-25.*

***Drumsticks (Nos. 11500-38, -39, -40)***

*See entries under that of 11500-11.*

*Spool (No. 11500-41)*



In process view. *Photography by M. West.*

*Description:* Iron or tin spool-like object. Similar to a spool with four radiating arms

*Function:* Unknown.

*Measurements:* 12.5 cm diameter, 4.5 cm width.

*Conservation Method:* As of this writing, still in process.

*La Salle Expedition References:* None discovered.

*Archaeological References:* None.

*Additional References:* None discovered.

***Fork (No. 11500-42)***



*Photography by J. Swanson.*

*Description:* Pewter three-tine fork with trifid-shaped head. Maker's mark stamp reads *M CARDIN* and *FIN* and portrays two hands clasping beneath a crown. Ownership initials are unclear, but probably read "IO" or "JO."

*Function:* Eating utensil.

*Measurements:* See scale.

*Conservation Method:* Electrolysis at very low current density (2–5 amps, in 5% solution of sodium hydroxide). Rinsed in deionized water. Baking soda polish. Coated with Krylon Clear Acrylic 1301.

*La Salle Expedition References:* Joutel (1998:84, 93–94)

*Archaeological References:* Clausen (1965:24); Noel Hume (1969:180); Sténuît (1972:Figure 20); Stone (1974:177); Skowronek (1984:49, Figure 5.A); Wadley (1985:39, Figure 3); Hamilton (1992:356–360, Figures 226–227); Thornton (1992:94, Figure 17C); Carlin and Keith (1997:66)

*Additional References:* Massé (1904; 1971); Bailey (1927:7, 14, XLIX–L, Figures 64–65); Dourhoff (1958:9); Tardy (1959:12, 371); Diderot (1966:*Potiers d'Etain*, Figures 116–119); Hackenbroch (1969:Figures 69, 71); Boger (1983:16–17, Figure 30); Cotterell (1985); Hoyt (1985); Giblin (1987:47, 52–53); Hornsby (1989:15–17, 46); Gotelipe-Miller (1990:8–51); Brigadier (2002:83–94)



*Chinces (Nos. 11500-43, -44)*



1 bar = 2.5 cm. *Photography by M. West.*

*Description:* Flared blade; wooden handle with iron rings around top and bottom.

*Function:* Used to drive threads of oakum between the hull planking of a ship.

*Measurements:* See scale for wooden handles.

*Conservation Method:* Iron: Epoxy Hysol cast made of original's remains. Wood: Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

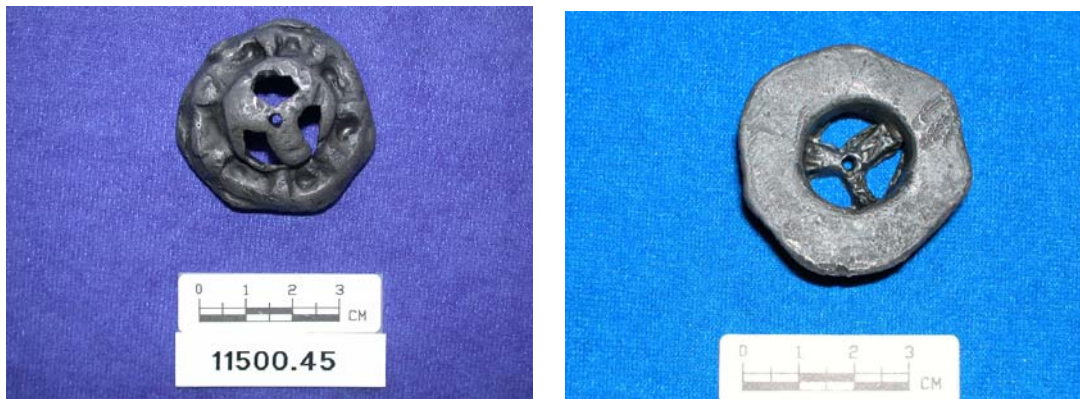
*La Salle Expedition References:* None discovered.

*Archaeological References:* Cederlund and Ingelman-Sundberg (1973:320); Green (1977:267); Marsden (1976:208, 210, Figure 5); Ross (1981:206–208, 346, 349, Figures 74, 131); Crisman (1987:241, 250, To. 2); Franklin (1992:69–74, 76–91, Figures 46–53); Custer (2004:148–152, Figures 86–90)

*Additional References:* Petrie (1916); Sloane (1964:52, 55); Diderot (1966:*Architecture maçonnerie*, Plate XII, Figure 112; *Glaces*, Figure 10; *Mineralogie*, Figure 9); Kilby (1971:40, 79, Plate 50); Salaman (1975:116–118, 122, 136–137, Figures 187/2, 188h, 205w); McNerney (1979:117); Seymour (1984:119)



***Pump Valve (No. 11500-45)***



*Photography (left) by J. Swanson and (right) by M. West.*

*Description:* Hexagonal lead piece with large hole in middle and three arms that arch upward to meet in the center of the large hole. In the juncture of these arms is another small hole. Around the edges of one side are rough depressions.

*Function:* Unknown, possibly valve for a small hand pump.

*Measurements:* See scale.

*Conservation Method:* Submersion in 10% hydrochloric acid. Boiled in ammonium acetate. Boiling rinse in deionized water. Submerged in microcrystalline wax.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Keith et al. (1984:56–57, Figure 13); Oertling (1996:34–35, Figures 18–19)

*Additional References:* None discovered.

***Firmer Gouge (No. 11500-46)***  
*See entry under that of 11500-35.*

*Triangular Padlock (No. 11500-47)*



Preconservation view. *Photography by M. West.*

*Description:* Small triangular iron padlock with brass leafing.

*Function:* Padlocking small items, such as small personal boxes.

*Measurements:* See scale.

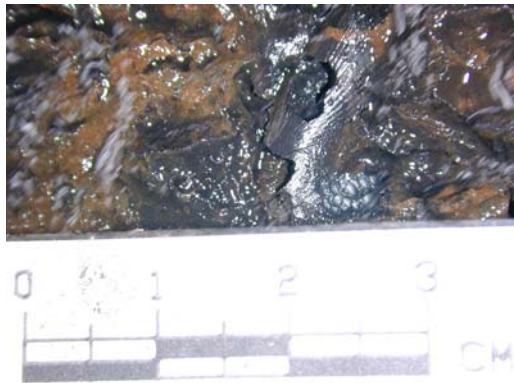
*Conservation Method:* Brass Leafing: Electrolysis (solution of 5% sodium hydroxide). Boiling rinse in deionized water. Immersion in 3% benzotriazole (BTA) in ethanol. Coated with Krylon Clear Acrylic 1301.

*La Salle Expedition References:* None discovered.

*Archaeological References:* Wingood (1982:345, Figure 19)

*Additional References:* Eras (1957:48, Figure 65); Diderot (1966:*Serruriers*, Figure 28); Noel Hume (1969:250, Figure 79); Thornton (1992:163–165, Figure 42); Arnall (1996:158, Figure 38)

***Roaches (No. 11500-48)***



*Photography by M. West.*

*Description:* Numerous roach wings and body parts.

*Function:* Non-cultural.

*Measurements:* See scale.

*Conservation Method:* Dehydration in deionized water, ethanol, and acetone. Submersion in silicone oil (85%)/MTMS crosslinker (15%) solution. Cleaned with MTMS. Catalyzed with DBTDA.

*References:* None discovered.

***Auger (No. 11500-49, -50, -51, -52, -53)***  
***See entry under that of 11500-29.***

*Tin Sheeting (No. 11500-54)*



*Photography by M. West.*

*Description:* Thin layers (approximately three) of tin sheeting spread over the bottom of the chest.

*Function:* Unknown, possibly for waterproofing or protection, but not secured to chest's bottom.

*Measurements:* None.

*Conservation Method:* Microcrystalline wax.

*References:* None discovered.

*Small Chisels (Nos. 11500-55, -56)*



Chisel 11500-55, in situ. *Photography by M. West.*

*Description:* All iron, parallel sided shaft, sharpened with one bevel

*Function:* Strong enough to be struck with a mallet, or for rough work in carpentry, military work, wagon building, etc.

*Measurements:* See scale.

*Conservation Method:* Epoxy Hysol cast made of original's remains.

*La Salle Expedition References:* None discovered.

*Archaeological References:* None discovered.

*Additional References:* Petrie (1916); Salaman (1975:130)

## APPENDIX C

### VESSEL INFORMATION

Vessel Name	Year of Loss	Nationality	Wreck Location
Uluburun wreck	c. 1300 BCE	Syro-Palestinian	near Kas, Turkey
Oseberg ship	c. 820-834	Norwegian	Oslo, Norway
Molasses Reef wreck	early-16th C	Iberian	Turks and Caicos Islands
Cattewater wreck	1530	Iberian	Plymouth Sound, England
<i>Mary Rose</i>	1545	English	in the Solent, England
Seychelles wreck	mid-16th C	Portuguese	Seychelles, near Madagascar
<i>Ann Francis</i>	1583	English	South Wales, England
<i>El Gran Griffon</i>	1588	Spanish	Shetlands
<i>Girona</i>	1588	Spanish	Port Na Spaniagh, Ireland
<i>Santa Maria de la Rosa</i>	1588	Spanish	Basket Sound, Ireland
<i>Nossa Senhora dos Martires</i>	1606	Portuguese	Tagus River, Portugal
<i>Sea Venture</i>	1609	English	Bermuda
<i>Wasa</i>	1628	Swedish	Stockholm, Sweden
<i>Batavia</i>	1629	Dutch	Houtman Abrolhos Islands
Passa Pau wreck	post-1645	Unknown	Cape Verde Islands
Stonewall wreck	1650	Spanish	Bermuda
<i>Lastdrager</i>	1653	Dutch	Yell, Shetland Islands
<i>Vergulde Draeck</i>	1656	Dutch	Western Australia
Pipe wreck	c. 1651-1665	Dutch? English?	Dominican Republic
<i>Kennemerland</i>	1664	Dutch	Out Skerries, Shetland
<i>Santo Christo de Castello</i>	1666	Dutch/Genoese	Mullion Cove, Cornwall, England
<i>Sacramento</i>	1668	Portuguese	Brazil
<i>Kronan</i>	1676	Swedish	Oland, Sweden
<i>Santo Antonio de Tanna</i>	1697	Portuguese	Mombasa Harbor, Fort Jesus
<i>Dartmouth</i>	1690	English	Sound of Mull, England
<i>Swan</i> , H.M.S.	1692	English	Port Royal, Jamaica
Jutholmen wreck	1700 or after	Swedish	Stockholm archipelago, Sweden
<i>Meresteyn</i>	1702	Dutch	Cape Town, South Africa
<i>Speaker</i>	1702	Pirate	Mauritius Island
<i>Hazardous</i> , H.M.S.	1706	English	Bracklesham Bay, England
<i>Association</i>	1707	English? Dutch?	Scilly Islands, England
<i>de Liefde</i>	1711	Dutch	Out Skerries, Shetland
5 <i>flota</i> vessels	1715	Spanish	Cape Canaveral, Florida
<i>Whydah</i>	1717	Pirate	Cape Cod, Massachusetts
<i>Curacao</i>	1729	Dutch	Shetland Islands
12 <i>flota</i> vessels	1733	Spanish	Florida Keys
D 15	post-1742	Dutch	near Lelystad, Netherlands
<i>Hollandia</i>	1743	Dutch	Scilly Islands, England
<i>Amsterdam</i>	1749	Dutch	Hastings, England
<i>Machault</i>	1760	French	Chaleur Bay, Canada
<i>Boscowan</i> , H.M.S.	post-1763	British	Lake Champlain, Vermont
<i>Philadelphia</i>	1776	American	Lake Champlain, Vermont
<i>Evstafii</i>	1780	Russian	Shetland Islands
<i>Betsy</i>	1781	British	Yorktown, Virginia
<i>Colossus</i> , H.M.S.	1798	English	Scilly Islands, England
<i>Defence</i>	1779	American	Penobscot Bay, Maine
<i>Eagle</i>	1820s	American	Lake Champlain, Vermont
<i>Eglinton</i>	1852	English	Western Australia

Vessel Name	Vessel Type	Reference
Uluburun wreck	Merchant	Pulak 1998
Oseberg ship	Viking	Ingstad 1982
Molasses Reef wreck	Exploration (?)	Keith <i>et al.</i> 1984
Cattewater wreck	Warship(? - Armed Vessel)	Redknap 1984
<i>Mary Rose</i>	Warship	Richards 1997
Seychelles wreck	Merchant	Blake and Green 1986
<i>Ann Francis</i>	Merchant	Redknap and Besly 1997
<i>El Gran Griffon</i>	Warship (Armada)	Martin 1972
<i>Girona</i>	Warship (Armada galleass)	Stenuit 1972
<i>Santa Maria de la Rosa</i>	Warship (Armada)	Martin 1975
<i>Nossa Senhora dos Martires</i>	Merchant (East Indiaman)	Castro 2003
<i>Sea Venture</i>	Colonizer	Wingood 1982
<i>Wasa</i>	Warship	Bengtsson 1975
<i>Batavia</i>	Merchant (East Indiaman)	Stanbury 1974
Passa Pau wreck	Unknown	Smith 2002
Stonewall wreck	Transport or Warship (Convoy)	Dethlefsen 1977
<i>Lastdrager</i>	Merchant (Flute)	Stenuit 1974
<i>Verqule Draeck</i>	Merchant (Yacht)	Green 1977
Pipe wreck	Merchant	Hall 1996
<i>Kennemerland</i>	Merchant (East Indiaman)	Price and Muckelroy 1974
<i>Santo Christo de Castello</i>	Merchant	Lam <i>et al.</i> 1974
<i>Sacramento</i>	Warship (Galleon)	Pernambuco de Mello 1979
<i>Kronan</i>	Warship	Einarsson 1997
<i>Santo Antonio de Tanna</i>	Warship (Frigate)	Piercy 1977
<i>Dartmouth</i>	Warship (5th-rate)	Muckelroy 1978
<i>Swan</i> , H.M.S.	Warship (5th-rate)	Clifford 1993
Jutholmen wreck	Merchant	Ingelman-Sundberg 1976
<i>Meresteyn</i>	Merchant (East Indianman)	Marsden 1976
<i>Speaker</i>	Pirate	Lize 1984
<i>Hazardous</i> , H.M.S.	Warship	Owen 1988
<i>Association</i>	Merchant (East Indiaman?)	Morris 1984
<i>de Liefde</i>	Merchant (East Indiaman)	Bax and Martin 1974
5 <i>flota</i> vessels	Transport	Clausen 1965
<i>Whydah</i>	Pirate (former slave galley)	Hamilton 1992
<i>Curacao</i>	Warship	Stenuit 1977
12 <i>flota</i> vessels	Transport	Skowronek 1984
D 15	Transport ( <i>praam</i> -like, inland)	van Holk 1997
<i>Hollandia</i>	Merchant (East Indiaman)	Cowan and Marsden 1975
<i>Amsterdam</i>	Merchant (East Indiaman)	Marsden 1974
<i>Machault</i>	Warship (Convoy frigate)	Sullivan 1986
<i>Boscowan</i> , H.M.S.	Warship (Sloop)	Erwin 1994
<i>Philadelphia</i>	Warship (Continental Gondola)	Bratten 1997
<i>Evstafii</i>	Transport (Pink)	Stenuit 1976
<i>Betsy</i>	Merchant (transport)	Broadwater 1996
<i>Colossus</i> , H.M.S.	Warship	Morris 1984
<i>Defence</i>	Warship (Brigantine privateer)	Smith 1986
<i>Eagle</i>	Warship (Brigantine privateer)	Crisman 1987
<i>Eglinton</i>	Merchant (Barque)	Stanbury 2003

## APPENDIX D

### JAMAICAN WOODWORKERS' TOOLS

Note: "x" denotes an unreadable letter. All transcriptions except John Philpott by the author, MCW.

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Inventory, Vol. 2, folio 89, Jamaica Public Archives

William Petty, Carpenter, Parish of St. Mary

Inventory Date: March 14, 1684

"One xez Txxx Squares One Plaine one Cold Chisell" worth 3 shillings, 1.5 pence

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Inventory, Vol. 2, folio 148, Jamaica Public Archives

Thomas Finch, Carpenter, Parish of St. Mary

Inventory Date: [unknown, but probably 1685 based on location in records]

"42 Small plaines, & 13 spare Irons, five Joyntors, & two squares  
 Two Jack plaines, & Smoothing plaine, One Rule & 7 augurs  
 Two broad axes & Twenty foure chizells, three hand sawes  
 One Cross cutt sawe, nine Flemish tooles, five hammers"  
 worth 6 pounds, 17 shillings, 6 pence

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Inventory, Vol. 3, folio 221, Jamaica Public Archives

John Biggs, Joiner, Parish of Vere

Inventory Date: August 10, 1688

"One parcel Plaines and Augers" worth 1 pound, 10 shillings  
 "One Vize and a Cronse" worth 1 pound, 10 shillings  
 "One parcell Joyners Tooles" worth 3 pounds  
 "7 Sawes" worth 2 pounds  
 "One parcell Punch Bowles and Morters" worth 1 pound  
 "One Large Punch Bowles" worth 5 shillings  
 "One parcel of Table frames and x Cases" worth 1 pound, 10 shillings  
 "A px of Stilliyards" worth 5 shillings  
 "A x parcell Timber" worth 5 shillings  
 "A Grindings Stone and Breaker" worth 2 shillings

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Inventory, Vol. 3, folio 285-290, Jamaica Public Archives

John Philpott, Blacksmith, Parish of Port Royal

Inventory Date: September 1, 1689 [signed/sealed]

"5 doz & ½ of Bambury Stock Locks" worth 11 pounds  
 "10 Stock & Spring Locks 4s a peece" worth 2 pounds  
 "6 Plate Stock Locks" worth 12 shillings  
 "15 Stock Locks at 12s p" worth 15 shillings  
 "21 Bastard Bambury Locks 8sp" worth 15 shillings  
 "12 Small Ord. Stock Locks" worth 5 shillings  
 "12 Inside small x Chest Locks" worth 7 shillings  
 "20 Middle Ditto" worth 12 shillings, 6 pence  
 "11 Box Locks" worth 5 shillings  
 "12 Inside Small x Chest Locks" worth 7 shillings  
 "40 x Keyed till & Chest Locks 5sp" worth 16 shillings, 3 pence  
 "11 swallow Bowed x Chest Locks 10sp" worth 9 shillings, 2 pence  
 "13 Large Chest Locks at 8sp" worth 10 shillings  
 "5 Sea Chest Locks" worth 12 shillings, 6 pence  
 "10 Doz x Keyed & plaine Cubbard Locks" worth 2 pounds, 10 shillings  
 "21 x Keyed Till Locks" worth 7 shillings  
 "11 Double x Cubbard Locks" worth 9 shillings, 2 pence  
 "1 Doz. Middle x Chest Locks" worth 7 shillings, 6 pence  
 "1 Doz x Cubbard Locks to *Cutt* [cull ?]" worth 5 shillings  
 "16 Pew Locks & Keyes" worth 15 shillings  
 "1 Doz x Keyed Chest Locks" worth 9 shillings  
 "5 Sea Chest Locks" worth 1 pound  
 "7 x Cubbard Locks" worth 3 shillings  
 "3 Doz & 5 x Keyd outside Chest Locks" worth 13 shillings  
 "10 Outside x Chest Locks" worth 5 shillings  
 "30 Iron Rim Locks Brass Knobbs 3s6d p" worth 5 pounds, 5 shillings  
 "3 Iron Rim Locks in a shute" worth 1 pound, 2 shillings, 6 pence  
 "6 Double Spring Locks" worth 7 shillings, 6 pence  
 "38 Rusty Single Spring Locks" worth 12 shillings, 8 pence  
 "18 pr of old Rusty spurrs" worth 1 pound, 6 pence  
 "1 old Rim Lock" worth 2 shillings  
 "3 Spring Latches" worth 2 shillings  
 "11 Plate Boults" worth 3 shillings  
 "2 pr of spurrs" worth 1 shilling  
 "86 Rusty Marking Irons" worth 1 pound, 1 shilling, 6 pence  
 "6 Outside Chest Locks" worth 2 shillings, 6 pence  
 "4 grose & 21 Doz of women cotton squares at 3s6d p grose" worth 14 shillings, 7 pence  
 "3 grose of childrens squares 2s6d p" worth 7 shillings, 6 pence  
 "3 Cases Ivory Haft Forks" worth 1 pound, 4 shillings  
 "15 Scritore Locks and a pcell of old Locks wthout keys" worth 3 pounds  
 "9 Doz: Round and Splenter Locks" worth 1 pound, 2 shillings, 6 pence  
 "A pcell of old Round Locks" worth 6 shillings  
 "6 Steele Sawes 3 feett long" worth 3 pounds  
 "2 x cutt sawes" worth 1 pound, 8 shillings

"2 Ditto" worth 1 pound, 16 shillings  
 "4 Row Busk Symiters" worth 2 pounds  
 "2 Symiters" worth 2 pounds  
 "1 Silver Hilted Rapier" worth 2 pounds  
 "1 Ordinary Ditto" worth 1 pound, 10 shillings  
 "2 Silver handled Rapiers" worth 17 shillings, 6 pence  
 "2 Ord. Smiters" worth 12 shillings  
 "A pcell of Old Duff taile hinges" worth 10 shillings  
 "8 Doz Carving Tooles att 2s p doz" worth 16 shillings  
 "6 Morticeing Chisells" worth 2 shillings, 3 pence  
 "9 Doz & 4 Gudges" worth 1 pound, 7 shillings, 9 pence  
 "8 Doz & 10 headings Chizells" worth 1 pound, 6 shillings, 6 pence  
 "8 Doz London Knife Blades 2 6 p doz" worth 1 pound  
 "A pcell of Rusty Knife Blades" worth 6 shillings  
 "19 Sugar Boarers" worth 19 shillings  
 "4 Whimble Bitts" worth 2 shillings, 6 pence  
 "A pcell of Pewter Bitts" worth 1 pound  
 "1 Doz. of Iron Compasses" worth 1 shilling, 6 pence  
 "A pcell of heading chizells" worth 1 pounds, 4 shillings  
 "A pcell of old plaine Irone" worth 1 pound  
 "A pcell of old Carving tooles & Chisells" worth 1 pounds, 10 shillings  
 "4 Doz. Rules at 14s p doz" worth 2 pounds, 16 shillings  
 "6 Scales" worth 5 shillings  
 "200 Broad Chizells" worth 6 pounds, 5 shillings  
 "2 Broad Axes 2s6 a peece" worth 3 pounds, 12 shillings, 6 pence  
 "A pcell of old Chizells" worth 10 shillings  
 "4 Doz. Intch Chizells 4s6d p doz" worth 18 shillings  
 "5 Doz ½ Joyners Hatchetts" worth 5 pounds  
 "21 Doz narrow howes at 11s p" worth 11 pounds, 11 shillings  
 "19 Doz & 7 Broade howes at 13s p" worth 13 pounds, 14 shillings, 2 pence  
 "26 addzes" worth 2 pounds, 10 shillings  
 "A pcell sledges qt 459 li" worth 11 pound, 7 shillings  
 "A pcell of Bick Irons 180" worth 4 pounds, 10 shillings  
 "A parcell of Bullits qt 622" worth 5 pounds, 3 shillings, 8 pence  
 "26 Doz old Augers 3 6 p doz" worth 4 pounds, 11 shillings  
 "13 old whipsawes" worth 5 pounds, 4 shillings  
 "A Marking Iron" worth 2 shillings, 6 pence  
 "32 Coopers adzes & howells 2s a peece" worth 3 pounds, 4 shillings  
 "4 old Coopers axes" worth 1 pound, 12 shillings  
 "2 Doz & 3 old Rusty Axes" worth 12 shillings, 6 pence  
 "4 Rounding Knifes" worth 4 shillings  
 "23 Joyners Axes" worth 1 pound, 14 shillings, 6 pence  
 "1 Bung Boarer" worth 2 shillings, 6 pence  
 "2 Doz & 5 Sugar Boarers 6s a peece" worth 1 pound, 6 shillings, 6 pence  
 "2 Doz & 5 old Bitts" worth 1 pound, 9 shillings  
 "2 pr Coopers compasses" worth 2 shillings, 6 pence  
 "5 Coopers adzes" worth 10 shillings  
 "2 Doz & ½ of Bitts" worth 1 pound, 11 shillings  
 "10 old Rusty Bitts" worth 5 shillings  
 "8 small frowes 3 of them old ones" worth 10 shillings  
 "9 small hatchetts" worth 4 shillings, 6 pence  
 "6 morticeing axes" worth 7 shillings, 6 pence  
 "1 plaine" worth 1 pound, 6 shillings

"23 old hand sawes broken & whole" worth 15 shillings  
 "17 Joyners Axes" worth 2 pounds  
 "4 Joyners hatchetts" worth 6 shillings  
 "2 Joynter Irons" worth 2 shillings  
 "1 curryers knife" worth 2 shillings, 6 pence  
 "5 Morticening axes" worth 7 shillings, 6 pence  
 "4 Large Augers" worth 10 shillings  
 "2 Crowse Iron" worth 1 shilling  
 "2 Bick Irons" worth 10 shillings  
 "4 compasses & a small compass" worth 1 pound, 2 shillings, 6 pence  
 "1 Doz & ½ of Baskwords" worth 6 pounds, 15 shillings  
 "58 old swords 3 6 a peese" worth 10 pounds, 3 shillings  
 "8 pr of old Bullitt moulds" worth 2 shillings, 6 pence  
 "57 old swords 3s a peese" worth 8 pounds, 11 shillings  
 "3 basket hilted swords" worth 1 pound  
 "3 Childrens swords" worth 2 shillings, 6 pence  
 "13 Doz ½ pad locks 6s p doz" worth 6 pounds, 10 shillings  
 "2 m. ½ truss hoops nailes 15s p" worth 1 pound, 17 shillings, 9 pence  
 "10 old swords" worth 1 pound  
 "3 x cutt sawes" worth 15 shillings  
 "10 steel whipp sawes plates" worth 8 pounds  
 "26 old sword handles" worth 5 pounds  
 "13 ounces silver wyer 69 p" worth 3 pounds, 18 shillings  
 "1 Chest & press" worth 3 pounds  
 "1 Chest of Drawers & a glass case" worth 2 pounds, 10 shillings  
 "372 sword blades at 1s6d p" worth 26 pounds, 8 shillings  
 "12 doz scabbards" worth 3 pounds  
 "4 Doz & 4 sword blades 2 6 a peese" worth 6 pounds, 10 shillings  
 "A pcoll of old tin" worth 5 shillings  
 "1 old chest of drawers a bed & chest" worth 1 pound  
 "An old Chest & Box" worth 10 shillings  
 "13 old sawes" worth 1 pound, 16 shillings  
 "5 li ½ of old lead 10s p li" worth 2 pounds, 9 shillings

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Inventory, Vol. 6, folio 128, Jamaica Public Archives

William Newman, Carpenter, Parish of St. Elizabeth

Inventory Date: June 6, 1703 [entered into Public Records]

“To 20 old plaine Irons” worth 1 pound  
“To 10 old inch Augers” worth 12 shillings, 6 pence  
“To 3 inch and a halfe ditto” worth 7 shillings, 6 pence  
“To 13 quarter ditto” worth 1 shilling, 3 pence  
“To 7 pareing [parcing?] Chissells” worth 7 shillings  
“To 18 other Chissells” worth 1 pound  
“To 7 Rabbating Irons” worth 5 shillings  
“To 6 firmers” worth 5 shillings  
“To 1 old file” worth 7.5 pence  
“To 27 Flemish Goudges” worth 1 pound  
“To 16 small Ditto” worth 7 shillings, 6 pence  
“To 15 small Mortising Chissells” worth 15 shillings  
“To 4 small smoothing plaines” worth 5 shillings  
“To 2 jack plaines” worth 5 shillings  
“To 2 Large plaines” worth 6 shillings, 3 pence  
“To 1 spring ditto” worth 3 shillings, 1.5 pence  
“To 1 bedmolding” worth 3 shillings, 9 pence  
“To 5 Cornishing plaines” worth 18 shillings, 9 pence  
“To 3 Plows” worth 9 shillings, 4.5 pence  
“To 1 small D<sup>o</sup>” worth 1 shilling, 3 pence  
“To 11 halfe round Plaines” worth 1 pound  
“To 4 hollowers” worth 7 shillings, 6 pence  
“To 20 Rounds” worth 1 pound  
“To 15 OGs” worth 1 pound, 10 shillings  
“To 23 rounds more” worth 1 pound, 10 shillings  
“To 15 other small plaines” worth 1 pound  
“To 2 old jointers” worth 7 shillings, 6 pence  
“To 2 handsaws” worth 5 shillings  
“To 1 fine Tennant saw” worth 5 shillings  
“To 1 Compafs saw” worth 1 shilling, 3 pence  
“To 1 bow saw” worth 2 shillings, 6 pence  
“To 2 old brofseutt saws” worth 1 pound  
“To 1 joynter Mow” worth 2 shillings, 6 pence  
“To 2 Adds” worth 5 shillings  
“To 2 squares” worth 2 shillings, 6 pence  
“To 2 Wooden squares” worth 2 shillings, 6 pence  
“To 3 hammers” worth 3 shillings, 9 pence  
“To 1 other plow & smoothing plaine” worth 3 shillings, 9 pence  
“To 2 old Broad Axes” worth 5 shillings  
“To 1 Gimblett 1 braf s roule 1 old Rule and 1 p.cl of Compafses” worth 2 shillings, 6 pence

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Inventory, Vol. 9, folio 107, Jamaica Public Archives

John Ellis, Carpenter, Parish of St. George

Inventory Date: April 4, 1712

“To Three old adzes and broadax” worth 10 shillings

“To one old auger and gimblett” worth 2 shillings, 6 pence

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Inventory, Vol. 9, folio 177, Jamaica Public Archives

James Bradly, Carpenter, Parish of St. Anne

Inventory Date: April 7, 1712

“Forty and two old small plains at 1s3” worth 2 pounds, 12 shillings, 6 pence

“5 Ditto Large 12s6 and two broad axes 10s” worth 1 pound, 2 shillings, 6 pence

“4 adses 9s4 x x and 4 handsaws 15s” worth 1 pound, 4 shillings, 4.5 pence

“70 small Chifsels and plain Irons at 6 x x pxxs” worth 1 pound, 15 shillings

“20 old Chifsells at 1sxx1 5 harars and 5 saws L. 1” worth 2 pounds

“11 Turning Tools 12s9 7 old squares sawsets and gxx chests” worth 1 pound, 6 shillings, 3 pence

“2 Cornish plains 15s and one grindstone 10s” worth 2 pounds

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Inventory, Vol. 10, folio 48, Jamaica Public Archives

John King, Carpenter, Parish os St. Iago de la Vega

Inventory Date: April 20, 1713

“12 Moulding plains” worth 15 shillings

“2 long plains and 2 fore plains” worth 10 shillings

“1 [show? Hoe?] and 3 Bitts” worth 5 shillings

“6 plain Irons” worth 3 shillings, 1.5 pence

“3 plough Irons” worth 2 shillings, 6 pence

“An adds” worth 3 shillings, 1.5 pence

“A parcel of chisfels” worth 12 shillings, 6 pence

“2 augers” worth 5 shillings

“A saw” worth 7 shillings, 6 pence

“A Two foot Rule” worth 1 shilling, 3 pence

“A pair of Compafses Pincers and Hammer” worth 5 shillings

“A Rub stone and an Iron square” worth 5 shillings

“A parcel of Rubish” worth 5 shillings

“A Gunn” worth 1 pound, 10 shillings

“A Chest” worth 2 shillings, 6 pence

“2 old work Benches” worth 5 shillings

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Inventory, Vol. 10, folio 24, Jamaica Public Archives

John Shellet, Carpenter, Parish of Vere

Inventory Date: April 6, 1716

“To 48 Joyners plaines of Severall sorts att 18 x” worth 3 pounds, 12 shillings

“To 1 Jack plaine” worth 2 shillings, 6 pence

“To 1 Cros cutt Saw 1 hand Saw 1 Broad ax 1 adze 1 achitt 2 augers 1 hammer 9 Chisells 1 Square 1 Sett  
Saw and one Compos Saw all worne” worth 1 pound, 4 shillings, 4 pence

“To Sundry Carpenters Tooles very much worne” worth 15 shillings

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## APPENDIX E

### 1684 EXPEDITION MEMBERS

Surname	Given Name/Title	Notes
Aigron	Claude (d')	Captain of <i>Aimable</i>
Allais	Jean	Sailor
Alon	Elie d'	Sailor on <i>Aimable</i>
Arboul		
Augustin	Pierre	Sailor on <i>Aimable</i>
Barbier	Gabriel	Lieutenant
Barbier	Madame	Wife of Gabriel
Barbier		Baby born in Texas
Barteau	Jean	Sailor
Barthelemy	Pierre	
Baudry	Jean	Sailor on <i>Aimable</i>
Beaujeu	Taneguy Le Gallois de	Captain of <i>Joly</i>
Belliard	Francois	Carpenter or shipwright
Bigras	Jacques	Sailor on <i>Aimable</i>
Bihorel		Captain (soldier)
Boire	Jacques	Flour Miller
Bonardi	Pietro Pauollo di	Furrier and glover
Bouillan	Jean Philix	Ship's Pilot
Boutin	Jacques	Sailor on <i>Aimable</i>
Boutiron	Jean	Sailor on <i>Saint-Francois</i>
Breman		Soldier, father of Eustache
Breman	Eustache	
Breman	Madame	Mother of Eustache
Burel		Merchant
Cantain	Jean	Sailor on <i>Saint-Francois</i>
Carlot	Yvon	Sailor
Carpentier		
Cavalier	L'Abbe Jean	Sulpician
Cavalier, de La Salle	Robert	
Cavalier	Colin	Nephew to Cavalier de La Salle
Chaigneau	Pierre	Cooper
Chappeau	Antoine	Carpenter or shipwright
Chefdeville	Abbe de	Sulpician -- Brother to other?
Chefdeville	Abbe de	Cadet -- Brother to other?
Couillaud	Pierre	Carpenter or shipwright
Moranget	Colin Crevel de	Lieutenant, Cavalier de La Salle's nephew
Crugéon	Adrien	Sailor
Crugéon	Louis	Sailor on <i>Aimable</i>
Daneau		Hunter
Debois		1st Carpenter on <i>Aimable</i>
Desloges		Volunteer
Deveneau	Jean	Laborer
Dorneau	Abraam	Sailor on <i>Saint-Francois</i>
Douay	Le Pere Anastase	Recollet Franciscan
Du Hamel		Ensign of <i>Joly</i>
Dubeau	Jean	Sailor
Dubois	Helie	Sailor on <i>Saint-Francois</i>
Duclerc		

Surname	Alias	Reference
Aigron		Weddle (2001:121)
Allais		Weddle (2001:285, Note 16)
Alon		Weddle (2001:284, Note 9)
Arboul		Villiers (1931:217)
Augustin		Weddle (2001:284, Note 9)
Barbier	Minisme	Villiers (1931:217)
Barbier	La Princesse	Villiers (1931:217)
Barbier		Villiers (1931:217)
Barteau		Weddle (2001:285, Note 16)
Barthelemy		Villiers (1931:217)
Baudry		Weddle (2001:284, Note 9)
Beaujeu		Villiers (1931:217)
Belliard		Weddle (2001:285, Note 16)
Bigras		Weddle (2001:284, Note 9)
Bihorel		Villiers (1931:217)
Boire		Weddle (2001:285, Note 16)
Bonardi		Weddle (2001:124)
Bouillan		Weddle (2001:285, Note 16)
Boutin		Weddle (2001:284, Note 9)
Boutiron		Weddle (2001:285-286, Note 18)
Breman		Weddle (2001:122)
Breman		Villiers (1931:217)
Breman		Weddle (2001:122)
Burel		Villiers (1931:217)
Cantain		Weddle (2001:285-286, Note 18)
Carlot		Weddle (2001:285, Note 16)
Carpentier	Lecarpentier	Joutel (1998:133)
Cavalier		Weddle (2001:121)
Cavalier, de La Salle		Villiers (1931:218)
Cavalier		Weddle (2001:23)
Chaigneau		Weddle (2001:285, Note 16)
Chappeau		Weddle (2001:285, Note 16)
Chefdeville		Weddle (2001:121)
Chefdeville		Villiers (1931:218)
Couillaud		Weddle (2001:285, Note 16)
Moranget	Moranger	Weddle (2001:119)
Crugéon		Weddle (2001:285, Note 16)
Crugéon		Weddle (2001:284, Note 9)
Daneau	Devault	Villiers (1931:218)
Debois		Weddle (2001:284, Note 9)
Desloges		Villiers (1931:218)
Deveneau		Weddle (2001:285, Note 16)
Dorneau		Weddle (2001:285-286, Note 18)
Douay		Villiers (1931:217)
Du Hamel		Villiers (1931:218)
Dubeau		Weddle (2001:285, Note 16)
Dubois		Weddle (2001:285-286, Note 18)
Duclerc	Declaire	Villiers (1931:218)



Surname	Given Name/Title	Notes
Duhaut	Pierre	Merchant/sergeant -- Brother to Dominique
Duhaut	Dominique	Merchant -- Brother to Pierre
Dumesnil		Servant to La Salle
Duval		Scrivener aboard <i>Joly</i>
Esmenville	L'Abbe d'	
Fontaine		Soldier
Fougeron	Alain	Sailor
Gabaret	Christophe	2nd Pilot of <i>Joly</i>
Gayen		Volunteer
Georget	Pierre	Sailor on <i>Aimable</i>
Giraud		Captain of <i>Saint-Francois</i>
Grenot	Abel	Sailor
Grollet	Jacques	Sailor
Guerigenet	Yvon	Sailor on <i>Aimable</i>
Guichard		Soldier
Guitron	Francois	1st Pilot of <i>Joly</i>
Haraudi	Jacques	Shoemaker
Here	Le Chevalier d'	1st Lieutenant of <i>Joly</i>
Hiems		
Hurie		Volunteer
Jarry	Jean	
Jean	Francois	Carpenter or shipwright
Jean	Jacques	Volunteer
Joutard	Jacques	Sailor
Joutel	Henri	Volunteer
Juif	Sieur de	<i>Joly's</i> ship surgeon
La Jeunesse		Soldier
La Pierre	Bastien	Sailor on <i>Aimable</i>
La Roche	Pierre	Cooper
La Sablonniere	Le Chevalier de	Lieutenant
La Salle	Nicolas de	No relation to Robert Cavalier
La Treville	Vivien	Sailor
La Villeperdrix	De	Volunteer
Labaussair	Jacques	Baker (volunteer)
L'Archeveque	Jean	Valet to Duhaut
Le Clercq	Le Pere Maxime	Recollet Franciscan
Le Gros		Commercial Assistant to La Salle
Lebeau		Laborer
Leclerc		Hired hand
Lefebvres	Noel	Mason
Lemoine	Alain	Sailor on <i>Aimable</i>
Lespinne	Jean	Farm worker
Leuraud	Jean	Blacksmith
Liotot	Etienne	Surgeon-Major
Lucas	Jean	Pilot of <i>Saint-Francois</i>
Marle	De	Volunteer
Martin	Pierre	Sailor on <i>Aimable</i>
Massiot		Merchant
Massiot	Jean	Owner of <i>Aimable</i>
Membre	Le Pere Zenobe	Recollet Franciscan Superior
Merlin		Merchant

Surname	Alias	Reference
Duhaut	Du Haut	Weddle (2001:123)
Duhaut		Villiers (1931:218)
Dumesnil	L'Esperance?	Villiers (1931:218)
Duval		Villiers (1931:218)
Esmenville	Amonville, Damonville	Villiers (1931:217)
Fontaine		Margry (1876-1886[3]:543)
Fougeron		Weddle (2001:285, Note 16)
Gabaret	Cabaret	Weddle (2001:120)
Gayen	Goyen	Villiers (1931:218)
Georget		Weddle (2001:284, Note 9)
Giraud	Girault	Weddle (2001:125)
Grenot		Weddle (2001:285, Note 16)
Grollet	Groslet	Villiers (1931:218)
Guerigenet		Weddle (2001:284, Note 9)
Guichard		Margry (1876-1886[3]:543)
Guitron	Guitton	Weddle (2001:120)
Haraudi		Weddle (2001:285, Note 16)
Here		Villiers (1931:217)
Hiems	Hiens, Hans, James	Villiers (1931:218)
Hurie	Hurier	Villiers (1931:218)
Jarry	Gery	Villiers (1931:218)
Jean		Weddle (2001:285, Note 16)
Jean		Weddle (2001:124)
Joutard		Weddle (2001:285, Note 16)
Joutel		Villiers (1931:218)
Juif		Weddle (2001:120)
La Jeunesse		Margry (1876-1886[3]:543)
La Pierre		Weddle (2001:284, Note 9)
La Roche		Weddle (2001:285, Note 16)
La Sablonniere	Marquis de	Margry (1876-1886[3]:543)
La Salle		Villiers (1931:219)
La Treville		Weddle (2001:285, Note 16)
La Villeperdrix		Villiers (1931:219)
Labaussair		Weddle (2001:285, Note 11)
L'Archeveque		Villiers (1931:219)
Le Clercq	Leclercq	Villiers (1931:219)
Le Gros		Villiers (1931:219)
Lebeau		Weddle (2001:285, Note 16)
Leclerc		Villiers (1931:219)
Lefebvres		Weddle (2001:285, Note 16)
Lemoine		Weddle (2001:284, Note 9)
Lespinne		Weddle (2001:285, Note 16)
Leuraud		Weddle (2001:285, Note 16)
Liotot	Lanctot, Lantelot	Weddle (2001:124)
Lucas		Weddle (2001:285-286, Note 18)
Marle	de Marne	Villiers (1931:219)
Martin		Weddle (2001:284, Note 9)
Massiot		Weddle (2001:124)
Massiot		Villiers (1931:219)
Membre		Villiers (1931:219)
Merlin		Villiers (1931:219)

Surname	Given Name/Title	Notes
Meunier		
Meunier	Pierre	
Minet	Jean-Baptiste	Engineer
Mengaud	Zacharie	Pilot of Aimable
Monbeuil	Pierre	Sailor on Saint-Francois
Moraud	Daniel	Captain of Belle
Moreau	Pierre	Sailor on Aimable
Morel	Jean	Carpenter or shipwright
Nicollas	Jacobus	Cannoneer (gunner)
Nika		Indian Assistant to La Salle
Normand	Clement	Sailor on Aimable
Normand	Mattieu	Sailor on Aimable
Ory		
Paget		Bougois from La Rochelle
Paris	Mademoiselle	
Paugron	Moise	Sailor on Aimable
Pelle	Rene	Edge-tool maker
Perraud	Sanceau	Sailor on Aimable
Pimont		Clerk (commis)
Planterose	J.	Volunteer
Prevost	Andre	Sailor on Aimable
Ravenel		
Riber		Presence is in question
Richard	Pierre	Sailor on Saint-Francois
Richaud	Elie	1st Pilot of Belle
Ruillia	Pierre	Sailor on Saint-Francois
Ruine	Louis	Surgeon
Ruter		Sailor
Saget		Servant to La Salle
Savury	Louis	Sailor
Segefardois		Sailor on Aimable
Sellie		2nd Pilot of Belle
Simonet	Izaac	Sailor on Aimable
Saint-Jean-d'Angely		Servant girl from said town
Talon	Lucien	Carpenter, soldier
Talon	Isabelle	Wife of Lucien
Talon	Pierre	Child of Lucien and Isabelle
Talon	Jean-Baptiste	Child of Lucien and Isabelle
Talon	Lucien	Child of Lucien and Isabelle
Talon	Robert	Child of Lucien and Isabelle
Talon	Marie-Madeleine	Child of Lucien and Isabelle
Talon	Marie-Elisabeth	Child of Lucien and Isabelle
Tessier	Pierre	2nd Mate of Belle
Thibault		Volunteer
Thomas	Denis	
Turpin		Soldier
Valigny	Capitaine de	Commander of troops
Vallee	Guillaume	Flour miller
Varachieux	Pierre	Mason
Vigneau	Julien	Gardener
Vincent	Pierre	Master Carpenter

Surname	Alias	Reference
Meunier	Le Meusnier	Villiers (1931:219)
Meunier	Monnier	Villiers (1931:219)
Minet		Villiers (1931:219)
Mengaud	Mingaud	Villiers (1931:219)
Monbeuil		Weddle (2001:285-286, Note 18)
Moraud		Weddle (2001:126)
Moreau		Weddle (2001:284, Note 9)
Morel		Weddle (2001:285, Note 16)
Nicollas		Weddle (2001:285, Note 16)
Nika	Nikana	Villiers (1931:219)
Normand		Weddle (2001:284, Note 9)
Normand		Weddle (2001:284, Note 9)
Ory	Oris	Villiers (1931:219)
Paget		Weddle (2001:135)
Paris		Villiers (1931:219)
Paugron		Weddle (2001:284, Note 9)
Pelle		Weddle (2001:285, Note 16)
Perraud		Weddle (2001:284, Note 9)
Pimont		Villiers (1931:219)
Planterose		Villiers (1931:219)
Prevost		Weddle (2001:284, Note 9)
Ravenel		Villiers (1931:219)
Riber		Villiers (1931:219)
Richard		Weddle (2001:285-286, Note 18)
Richaud		Villiers (1931:219)
Ruilia		Weddle (2001:285-286, Note 18)
Ruine		Weddle (2001:124)
Ruter	Rut	Villiers (1931:219)
Saget	Sage, L'Esperance?	Villiers (1931:219)
Savury		Weddle (2001:285, Note 16)
Segefardois		Weddle (2001:284, Note 9)
Sellie		Villiers (1931:219)
Simonet		Weddle (2001:284, Note 9)
Saint-Jean-d'Angely		Weddle (2001:123)
Talon		Villiers (1931:219)
Talon		Villiers (1931:219)
Talon		Villiers (1931:219)
Talon		Villiers (1931:219)
Talon		Villiers (1931:219)
Talon		Villiers (1931:219)
Talon		Villiers (1931:219)
Talon		Weddle (2001:200)
Tessier	Tissier, Tixier	Weddle (2001:126)
Thibault		Villiers (1931:220)
Thomas		Villiers (1931:220)
Turpin		Margry (1876-1886[3]:543)
Valigny		Villiers (1931:220)
Vallee		Weddle (2001:285, Note 16)
Varachieux		Weddle (2001:285, Note 16)
Vigneau		Weddle (2001:285, Note 16)
Vincent	Carpentier, Le Carpentier	Villiers (1931:217)

## APPENDIX F

### WOODWORKING TOOL LISTS BY OCCUPATION

#### **Block Maker**

*Requisitions List for Block Maker Aboard 1653 Dutch Merchant Vessel Vergulde Draeck (Green 1977:392-394):*

1 regular axe, 6 hand axes, 1 adze, 1 butcher's knife, 1 draw knife, 8 regular gauges, 12 turning chisels, 12 turning gauges, 6 pit saws, 6 hand saws, 300 augers of different sizes, and a number of sheets, tackles, blocks, and gears

#### **Cabinet Maker**

*Requisitions List for Cabinet Maker Aboard 1653 Dutch Merchant Vessel Vergulde Draeck (Green 1977:392-394):*

a large number of planes, along with "24 hand axes, 36 three-cornered files, 36 chisels, 36 iron hammers, 36 punches, 12 bundles of reed, 30 compasses, 200 pounds of good lime, and 200 fine drill bits

#### **Caulker**

*French 74-Gun Caulker's Main Stores (Boudriot 1986:155):*

"blind- and riding plugs (6), caliper (1), caulking-irons (18), caulking-mallets (9), copper ash-pan for the stove (1), cow-hides (9), spare kersey (40 ells), sheet-lead (350 pounds), mallets (6), oakum (600 pounds), padlocks (2), pincers (1), dry pitch, pitch-ladle (1), pitch oil (1,250 pounds), pitch-pot (1), shot-tongs (1), stove for the wardroom (1), sulphur (8 pounds), and tallow (120 pounds)"

*French 74-Gun Ship's Caulker's Pump Stores (Boudriot 1986:155):*

"lower boxes (12), upper boxes (12), brakes (8), iron-hooped buckets for the pumps (3), hook rods (3), hammers (3), hides of thick leather (3), batten-nails (7 pounds), lead-nails (35 pounds), pump-nails (10 pounds), scupper-nails (45 pounds), bronze-barrelled pumps (6), copper head-pump (1), fire-pump and accessories (1), small stirrup-pumps (3), wooden wash-deck pump (1), wooden pump-spears (12), and turn screws (2)"

#### **Cooper**

*Requisitions List for Cooper Aboard 1653 Dutch Merchant Vessel Vergulde Draeck (Green 1977:392):*

40 wooden compasses, 12 heating irons, 150 ferret saws, 18 barrel axes, 200 dowel drills, 12 tongs, 18 plane benches, 100 wooden legger hoops, 12 wooden half legger hoops, 4 iron hoops, 2 cooper's axes, 100 half legger staves, 50 vercken staves, and 10 pieces of chalk

*Mid-18th Century French Warship's Cooper's Stores (Ross 1981:303):*

cooper's adzes or hammers, cooper's axes, cooper's stakes, bung borers, braces and bits, bar cramps, croze planes, dividers, hooping dogs, drawknives, hoop drivers, froes, cask gauges, gimlets, set hammers, truss hoops, cooper's blocks, shaving horse, branding irons, marking brushes, flagging irons, cooper's jiggers or chiv planes, cleaving knives, stuffing knives, cooper's mallets, cooper's jointer plane, drift punches, cooper's head saws, cooper's shaves, and heading vices

## Ship's Carpenter

*Requisitions List for Ship's Carpenter Aboard 1653 Dutch Merchant Vessel Vergulde Draeck (Green 1977:392-394):*

a large number of planes, as well as "200 brass compasses, 200 cutting axes, 200 adzes, 200 duim chisels, 200 paring chisels, 200 wooden braces, 200 heavy axes, 100 sledgehammers, 200 chisels and hatchet, 100 iron hammers, 100 squares, 200 hand-saws, 500 knife files", and a number of nails and springs

*Mid-18th Century French Warship's Ship's Carpenter's Stores (Ross 1981:110):*

adzes, augers, axes, bevels, driving bolts, calipers, chisels, crow bars, drawknives, braces and bits, files and rasps, marking gauges, gimlets, gouges, grindstones and whetstones, hammers, hold fasts, cant hooks, jacks, knives, levels and squares, mauls, pincers, planes, pump chain fids, pump gauge rods, rulers, saws, saw sets, proportional scales, turnscrews, splitting wedges, winches, and wrenches

*French 74-Gun Ship's Carpenters Stores (Boudriot 1986:143):*

"adzes including one hollow (236), anchor-stock for the spare anchor (1), anchor-stock bolts (8), anchor-stock hoops (5), augers (10), ship axes (6), beetles (7), bench-dogs (2), fir boards (70), slit fir deals (60), long and common bolts (25), bradawls (4), breastrail stanchions (42), breastrail stanchions for the tops (21), capstans equipped with bars (2), spare capstan bars (12), capstan hoops (2), chains for shrouds (9), chain and preventer-bolts (11), cold chisels (5), hand chisels (5), claw-hammers (7), haliard coiling-frames (4), sick-berth cots (65), spare deadeyes with hooks (9), draw-knives (2), drifts (10), entry port stanchions (8), flat, half-round, and square saw-sharpening files (4), forelocks (120), gimlets (10), gouges (5), complete grindstones (3), iron hasps or clamps (7), hoops (2), 8"+ spikes (100), 6" decknails (100), 5 1/3" single decknails (100), 4 1/2" single decknails (100), 4" ribband nails (80), 3 1/3" drawing-nails (80), 2 1/2" sheathing-nails (80), six-penny nails (80), diamond-head port-nails (45), padlocks (2), six-inch plank (1), five-inch plank (1), four-inch plank (2), two-inch plank (1), one-and-a-half inch planks (2), circular iron calipers (1), ragged ringbolts (11), ringbolts (12), rudder-head bolts (2), spare rudder-irons (4), rudder mould (1), cross-cut saw (1), frame-saws (2), ripping saw (1), seven-foot scantlings (11), spare futtock-shrouds (10), single and double spars (12), spike-levers (2), Prussia deals (3), staples of various sizes (65), tillers (3), complete tiller-rope tensioning-tackles (2), washers (120), iron wedges (8), spare double wheel (1), white lead (22 pounds), and wrain-staff and wrain-bolts (3)"

*U.S. frigate Alliance (1781-82) "A compleat Return of Sundries under the Care of the Carpenter" (Leavitt 1970:1323):*

a large number of spars, spikes and nails of various sizes, bolts, chains, and other spare ironwork, as well as the following tools: "axes (3), adzes (3), mauls (3), handsaws (3), chisels (12), spike gimlets (10), small gimlets (24), calipers (1), compasses (4), iron square (1), rules (4), chalk lines (4), whipsaw (1), crosscut saw (1), keyhole saw (1), panel saw (1), handsaw files (6), crosscut saw files (6), whipsaw files (2), handsaw set (1), caulking mallets (2), caulking irons (12), jointer (1), bead planes (2), smoothing planes (2), fore plane (1), hammers (6), cold chisels (6), augers (12), drawing knives (3), starting hammers (2), grindstones (2), rat tail file (1), wood axes (6), and small gimlets (4)"

# APPENDIX G

## LETTER OF PERMISSION



### TEXAS HISTORICAL COMMISSION

*The State Agency for Historic Preservation*

RICK PERRY, GOVERNOR

JOHN L. NAU, III, CHAIRMAN

F. LAWRENCE OAKS, EXECUTIVE DIRECTOR

January 25, 2005

Mr. Michael C. West  
4680 Battles Rd.  
Ashtabula, OH 44004

Dear Michael:

You have permission to use three images as noted in the attached e-mail for your thesis.  
God luck on the completion of the thesis.

Sincerely,

James E. Bruseth, Ph.D.  
Director, Archeology Division

JEB/lt

## VITA

MICHAEL CARL WEST

4680 Battles Road  
Ashtabula, OH 44004

EDUCATION: M.A., Anthropology, Texas A&M University (May 2005)

A.B., Archaeology, Cornell University (May 2001)

MAJOR PROJECTS: La Belle (2001–2005)

Kyrenia Shipwreck Project (Summer 2004)

Sotira-Kaminoudhia, Cyprus (Summer 2004)

Red River (Summer 2003)

Townley-Read Site Faunal Analysis (2000–2001)

Baughers House Archaeological Project (2000–2001)

Aegean Dendrochronology Project (1999–2001)

Akumal Coral Reef Survey (Summer 2000)

Tel Dor Archaeological Project (Summer 1999)